ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LXIV, No. 5. CHICAGO, SATURDAY, JANUARY 31, 1914. ISSUED WEEKLY.

COMPRISING

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY
608 SOUTH DEARBORN STREET
CHICAGO

Charles W. Price, President and Treasurer.
A. A. Gray, General Manager. H. S. Tuthill, Business Manager.
J. B. McCarthy, Asst. Gen. Mgr. C. W. Forbrich, Asst. Bus. Mgr.

E. E. Wood . . . . . 13 Park Row, New York, N. Y.
Manager Eastern States.
J. B. McCarthy . . . . . Detroit, Mich.
Manager Middle States.
C. W. Forbrich . . . . . Chicago, Ill.
Manager Western States.

ELECTRICAL REVIEW AND WESTERN ELECTRICIAN

Charles W. Price.....Editor-in-Chief
A. A. Gray.....Managing Editor
Morton Githens Lloyd.....Technical Editor
F. H. Bernhard.....Associate Editor
Howard Ehrlich.....Associate Editor

SUBSCRIPTIONS.

One Year, United States.....$3.00
One Year, Canada..... 4.00
One Year, Foreign Countries..... 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIALS:
The Ten-Watt Lamp..... 211
Electric Equipment of Automobiles..... 212
Federal Co-operation with State Commissions..... 212
Depreciation..... 213

DEPARTMENTS:
Commercial Practice..... 220
Electric Sign Data..... 227
Electrical Construction..... 228
Dollar Wiring Kinks..... 231
Among the Supply Men..... 232
Public Service Commissions..... 233
New Electrical and Mechanical Appliances..... 245
Latest Approved Fittings..... 249
Current Electrical News..... 250
Record of Electrical Patents..... 257

LEADING ARTICLES:
Electricity in Rubber Mills..... 215
An Accounting System for Small Central Stations.—By H. G. D. Nutting..... 221
Some Facts Relating to Depreciation and Rate Making.—By Halford Erickson..... 234
The Relation of the Bureau of Standards to the Public Service Commissions.—By Edward B. Rosa..... 239

LETTER TO THE EDITOR:
The Jobber-Contractor Relation.—By E. M. Raetz..... 230

MISCELLANEOUS:
Chicago Automobile Show..... 214
Electric Vehicle Meeting in Chicago..... 214
Brooklyn Section Meeting..... 214
House-Wiring Campaign at Columbus..... 220
Educational Work of New York Edison Company..... 226
Wiring Fixtures.—By William A. Murray..... 228
Boosting for Quality..... 228
Quick Connection for Meter Testing.—By E. M. Lothrop.. 228
Removing Static Charge from a Belt.—By William T. Estlick..... 229
Midwinter Convention of Minnesota Contractors..... 229
A Convenient Test Board.—By Allan A. Cunningham, Jr. 229
Among the Contractors..... 230
Busbar for Plating Vats..... 230
Effective and Attractive Window Display..... 232
Northwestern Cedermen's Association Holds Convention.. 238
Fixture Design Discussed in Pittsburgh..... 240
Discussion of Subways and Railroad Terminals in Chicago 242
Planning Lighting Installations..... 242
Lackawanna Extends Wireless System..... 243
The Importance of the Current Strength on Brass Plating 243
Notes on War Engineering.—By P. S. Paganini..... 243

Copyright, 1914, by the Electrical Review Publishing Company.

THE TEN-WATT LAMP.

Progressive central-station men are coming to appreciate that the ten-watt tungsten lamp, when properly advertised and applied, is one of the best devices for encouraging the use of electricity that has ever been developed. It is not very far back to the days when the thought of any considerable number of these units being in use in a single house or store sent the cold chills down the back of the lighting-company manager, long accustomed as he was to thinking in terms of 50-watt, 16-candlepower carbon lamps. And it may be admitted that even today a good many managers still fail to realize the immense power for good residing in this humble but exceedingly important size of 10 watts per bulb as a long-hour burner in places not requiring intensified illumination. We have hinted this before in these columns, but no apologies are needed for referring to the matter in its relation to publicity and soliciting, particularly in the home and store.

The cheapness of service resulting from the use of a ten-watt lamp is little realized by the public. Take the ten-cent-per-kilowatt-hour rate as a basis, and the cost of burning one of these units all night long in these dark winter days barely reaches 1.5 cents, starting at dusk and running through to breakfast time. A half cent will cover an ordinary evening's run at a stairway landing, in a bathroom, on a porch, or in the cellar. It is time to let the customer know in no uncertain terms that if he operates lamps of this size in the odd corners of his establishment, he can be actually prodigal in his use of lamps without really feeling it. If he forgets to turn it out when he comes upstairs from attending to the furnace little harm is done. The old custom of turning off all the lamps every time one leaves the front end of one's apartment for the rear can be given up without the slightest fear that when the monthly bill comes in, the family savings will have to be invaded to meet it.

Until the householder has tried it, he cannot realize the difference in cheerfulness, comfort and safety which results from a liberal use of low-powered tungsten lamps around his place in locations where a high degree of illumination is not needed. One or two of these lamps left burning throughout the night in hallway or bathroom are sometimes invaluable in cases of sudden indisposition; they reduce the noise made by late comers to bed and prevent collisions in the darkness between sleepy members of the household and other objects of low or zero animation.

In the store the ten-watt lamp is equally useful in maintaining safe passage conditions to and from the basements; in the lighting of closets, window exhibits of limited size, doorways leading into stock rooms, bulkheads, rear entrances and safe exteriors. Instances could be multiplied almost without limit of the usefulness of such lamps, and if the central-station man comes to realize that one of these units burned for long periods may be of more value to him as a revenue earner than a device consuming much more power but operated for short times only, the results will soon be evident in his treasury. Nothing encourages the use of electricity on larger and larger scales more than its economical application in many small single installations. It is safe to say that if given half a chance, the ten-watt lamp will do more to discourage hair-splitting economies in the use of electricity by the consumer than any other practical lighting unit adapted to residential and small store service.

ELECTRIC EQUIPMENT OF AUTOMOBILES.

The use of electricity in the propulsion of motor vehicles is making rapid strides. The electric vehicle has shown its superiority to the gasoline truck for most purposes where short hauls are involved, and it is rapidly invading the field of passenger cars where the gasoline engine has been often considered supreme. The recent automobile shows in New York City and Chicago have made it very evident, however, that aside from the use of electric power for propulsion, electric equipment has become an important part of the motor vehicle and is to be found to a larger and larger extent every year in the gasoline cars.

While for ignition purposes the electric spark has always been a feature of such cars, other electrical equipment has been taking an important place. The use of electric lamps for headlights has gradually found more and more favor until now it is acknowledged as the ideal equipment for the purpose, and is found on nearly all cars. Following the spark coil, the magneto and the electric lamp, came the introduction of the electric self-starter. Few of the better class of gasoline automobiles are now offered without this feature, which is almost indispensable for the convenient operation of the gasoline machine. In connection with the motor starter, the use of electric lamps has been made more feasible, since the storage battery can be charged from the same machine if desired, although a separate generator for this purpose is often preferred.

The electric brake is a rather new innovation and a number of minor conveniences are now supplied which are operated by means of electric current. Among these are signals for indicating to persons both in front and behind when a machine is going to turn a corner; arrangements for cutting down the glare of headlights; the electric gear shifter; and telephonic apparatus for communication between the passenger and chauffeur.

Altogether, there is hardly a booth nowadays at an automobile show in which electric equipment is not a predominating feature, and it may be safely said that it is the electric accessories which make it possible for the gasoline automobile to hold its position in the field.

FEDERAL CO-OPERATION WITH STATE COMMISSIONS.

The regulation of public utilities by state commissions seems to have been accepted by the people of this country as a definite program of procedure for preventing the evils which seem otherwise inherent in the control of monopolies by private corporations. Most of the states now have such state commissions and a number of them are clothed with very broad powers as to scope and jurisdiction over public utilities of all kinds.

One of the important elements in such control of public utilities is the establishment of standards of service and investigations as to whether operating companies conform to such standards. To properly carry out this function it is necessary for a commission to have the services of a competent, efficient and fairly large engineering staff with suitable facilities for carrying on its work. While many of the states have followed the lead of Wisconsin and New York in framing legislation on this matter, few, if any of them, have followed those states in providing through legislative appropriation for such an engineering staff as shall be capable of properly handling the questions which must come up to them for investigation and solution.

In view of the fact that work of this nature if properly carried out independently by our state commissions would involve an enormous amount of work and much duplication of effort in the different states, it would seem logical and mutually beneficial if much of this work could be done in co-operation or by one central agency supplied with the proper equipment in men and facilities for doing the work. Apparently no such move has yet been taken by the individual commissions or by their national organization, known as the National Association of Railway Commissioners, but many of the state commissions have turned to the National Bureau of Standards for assistance along these lines. With the idea of increasing its usefulness in this direction, the Bureau of Standards, through the Secretary of Commerce, has asked Congress for an appropriation of $100,000, so that it may be enabled to employ engineers especially for this purpose and to create in its organization a division or group of men who might give their whole time to investigations along these lines. If the members of Congress were familiar with what the Bureau of Standards has already accomplished and with the possibilities for good which exist in the

field here referred to, there would be no question about providing the funds for this important work. Most of the state commissions are not prepared to do all that it is desirable to have done and there is no need that each one should duplicate the work of the other. The help of the Federal Government would be quite appropriate in this direction, as it would be along the lines of the co-operative work which it is already doing through the Department of Agriculture, the Bureau of Education, the Bureau of Fisheries, and other federal agencies.

In a paper read before the last convention of the National Association of Railway Commissioners and reproduced in part in this issue, Dr. E. B. Rosa, chief physicist of the Bureau of Standards, has pointed out some of the ways in which the Bureau might be very helpful to the state commissions if such co-operation were made possible by Congress. Some work along this line has already been done, but at the expense of other activities of the Bureau, since men have had to be taken from other work in order to pay attention to such matters as the state commissions have requested the Bureau to take up. The making of electrical and other measurements which must enter largely into both the regulation and testing of service and in the metering of the product or commodity furnished by a public utility is directly in line with the work for which the Bureau of Standards was originally established. There is much other work, however, of an engineering nature which the experts of the Bureau are especially qualified to undertake, and they can, undoubtedly, be of great assistance to state commissions along such lines. A liberal policy upon the part of the Federal Government in rendering co-operation along these lines will be of direct benefit not only to commissions, to public service companies and to many industries, but also to the public at large.

There is no danger of federal interference in this manner with the authority of state commissions, since the services of the Bureau would be entirely in an advisory engineering capacity and would not be concerned with rates, accounting, capitalization and such matters as are not connected with standards of service or with engineering problems.

The Bureau has already given efficient help to a number of commissions along the line of establishing standards for gas and electric service and properly equipping the inspectors of the commissions with calibrated instruments and with methods for determining whether the standards are properly complied with. The technical problems connected with the work of regulation are increasing and there are doubtless many lines along which the assistance of the Bureau would be very helpful. The Intertstate Commerce Commission has already called upon it for co-operation in investigating the causes of railroad accidents so far as they relate to the use of defective material.

It is pointed out by Dr. Rosa that at least three of the states have, in the laws giving regulative authority to the state commission, specified that utility corporations shall be permitted to benefit in the form of stock dividends from economies in operation, which may be due to exceptional efficiency or improvement in methods of operation. This indicates that a larger rate of return upon the investment should be allowed under certain conditions of operation, the determination of which can only be adequately decided by engineering experts or at least through their help in specifying what conditions shall be regarded as standard and what as exceptional.

There can be no doubt that if the Bureau of Standards was provided with sufficient funds for the purpose it could soon build up an able staff of engineers and scientific assistants, who would be of great asssitance in the tremendous task which confronts the public utility commissions. But few of the state commissions have as yet gotten very deeply into their work. Most of their problems have yet to be worked out. If serious mistakes are made through lack of sufficient engineering assistance it would not only do injustice, but would be most regretable in indicating the failure of this method of regulation.

DEPRECIATION.

With the activity of state utility commissions in the regulation of rates of utility companies has come a more general recognition of the importance of giving proper attention to depreciation. This subject not only constitutes an important element in the determination of rates, but it is of course included in the standard systems of accounting which are being inaugurated by most of the state commissions. While the subject of depreciation upon its face appears quite simple, it is found to involve many difficulties when the attempt is made to properly consider it in the accounts of the utility company. Not only do the quantitative values for the depreciation offer frequent difficulties, but the distinction between depreciation which is to be covered by sinking fund and that which is to be covered by current repairs is not always simple. The article in this issue by Hon. Halford Erickson, of the Wisconsin Railroad Commission, should serve to make this matter more clear to utility managers, especially those connected with the smaller companies.

Of interest to the same class of managers will be the article by Mr. H. G. D. Nutting, which gives a convenient accounting system for the use of small central stations. The system involves no bound books, but a set of forms to be handled after the manner of the card index or the loose-leaf ledger, which is already common. A study of this system will no doubt be helpful to many.

Chicago Automobile Show.

The fourteenth annual show of the National Association of Automobile Manufacturers, occupying the entire Coliseum, Annex, First Regiment Armory and adjacent buildings was held in Chicago, January 26 to 31. The exhibit is credited with being the largest ever held, although fewer electrics were shown.

Aside from the exhibits of the vehicle manufacturers, however, the show is of significance to the electrical industry on account of the important position occupied by electrical apparatus in the gasoline car industry. Electric starting and lighting equipments for automobiles have made enormous advances during the past year and it is estimated that $25,000,000 will be spent for this equipment during 1914. Practically every manufacturer of gasoline cars represented at the show either provides electric lighting and starting equipments with the automobiles or is in a position to so equip their cars on demand.

The following manufacturers of electric vehicles were represented: Anderson Electric Car Company, Detroit; Argo Electric Vehicle Company, Saginaw, Mich.; Baker Motor Vehicle Company, Cleveland; Borland-Grannis Company, Chicago; Broc Electric Vehicle Company, Cleveland; Chicago Electric Motor Car Company, Chicago; Ohio Electric Car Company, Toledo; Rauch & Lang Carriage Company, Cleveland; Standard Electric Car Company, Jackson, Mich.; Woods Motor Vehicle Company, Chicago; and the Waverley Company, Indianapolis.

Electric Vehicle Meeting in Chicago.

The regular weekly meeting of the Chicago Section, Electric Vehicle Association of America, was held at the Lexington Hotel, on January 27. This location was selected because of its proximity to the Coliseum where the automobile show was in progress and several of the visitors attending this function were present at the meeting.

Captain Charles Healy, of the Chicago Police Department, in charge of the traffic squad, was the first speaker. He presented statistics showing the extent of the traffic congestion in the business district of the city which strikingly indicates the need for cooperation between police, vehicle operators and pedestrians. Captain Healy outlined the work of the traffic squad and commented on pending ordinances which if passed should tend to relieve congestion.

Hyden Eames, of Cleveland, was the next speaker. He spoke of the parking ordinance referred to by Captain Healy, pointing out that the availability of the electric is one of its main advantages and therefore some system should be devised whereby electrics could be parked so as not to interfere with traffic, but still be convenient to the business district. Mr. Eames briefly outlined the development of the electric vehicle industry and commented on the causes for its slow advance. The factor of safety of the electric was ample 15 years ago; the prices then or now are not excessive so that the main cause for the comparatively slow advancement has been lack of knowledge on the part of the public as to the advantages of the battery vehicle and lack of proper facilities for caring for the machines.

Mr. Eames said that the principal problem of the industry and one on which all elements meet on common ground is that of properly educating the public. In this connection private charging at home should be encouraged and in this the garage men should co-operate, as the business of the latter depends upon the gross number of electrics in use, whether charged at home or in public garages.

Brooklyn Section Meeting.

T. I. Jones, chairman of the Commercial Section, National Electric Light Association, and general sales agent of Edison Electric Illuminating Company of Brooklyn, delivered on January 12 his annual address before the members of the Brooklyn Company Section, N. E. L. A., on the development in the electrical field in Brooklyn during 1913.

E. A. Leslie presented a paper entitled, "Central-Station Service for Manufacturers." Mr. Leslie's paper brought forth spirited discussion from a number of members. Those who participated in the discussion were T. Bates, F. L. Leitner, J. L. Wilson, W. H. Grove, G. J. Leibman and C. H. Stevens.

More than 700 members of the Section and a number of out-of-town visitors connected with the industry attended. Mr. Jones's talk was illustrated with lantern slides covering specific installations, to show the trend toward the use of electric light, heat and power for Brooklyn homes, factories and stores. One feature that he laid particular stress on was the fact that within the limits of Brooklyn there are a number of farms that are completely equipped for electric service, including power for cow-milking machinery.

Following Mr. Jones, short addresses were made by a number of the visitors present, among whom were included: Theodore Beran, of the General Electric Company, New York; C. G. M. Thomas, of the New York & Queens Electric Light & Power Company; P. S. Young, of the Public Service Electric Company, Newark; H. H. Barnes, of the General Electric Company, New York; C. A. Littlefield, of the New York Edison Company; A. A. Pope, of the New York Edison Company; R. R. Young, of the Public Service Electric Company; W. J. Clark, of the Westchester Lighting Company, Mount Vernon; W. L. Second, of the Westchester Lighting Company; C. A. Barton, of the New York & Queens Electric Light & Power Company, Long Island City; L. A. Coleman, of the United Electric Light & Power Company, New York; C. A. Greenidge, L. R. Wallis, of the Edison Electric Illuminating Company of Boston.

The meeting was closed with the rendering of a vaudeville entertainment by employees of the Company.

Peoria Electric Club.

The Peoria Electric Club held the regular semi-monthly luncheon on Saturday, Januuary 24 and the following speakers each gave a five-minute talk on his subject: Theo. Bass, "Electricity on the Farm;" H. M. Butler, "Business Outlook for 1914;" E. R. Elam, "Jovianism;" E. H. Joseph, "Why is a Traveling Salesman;" L. L. Owen, "Continuous Service;" C. E. Stapp, "Does a Contractor—;" J. R. Yocum, "8,000 Miles in a Road Louse."

There was a debate on the subject "Resolved, That a Salesman Can Play Baseball," with J. Downs supporting the negative and Tom Endsley, the affirmative.

Colorado Association Officers.

The officers of the Colorado Electric Light, Power and Railway Association for the current year are as follows:

President: W. C. Sterne, vice-president and general manager of the Summit County Power Company, 1008 Gas and Electric Building Denver, Colo.

Vice-president: W. F. Raber, general manager of the Arkansas Valley Railway, Light & Power Company, Pueblo, Colo.

Secretary-treasurer: Thomas F. Kennedy, Denver Gas & Electric Light Company, Denver, Colo.

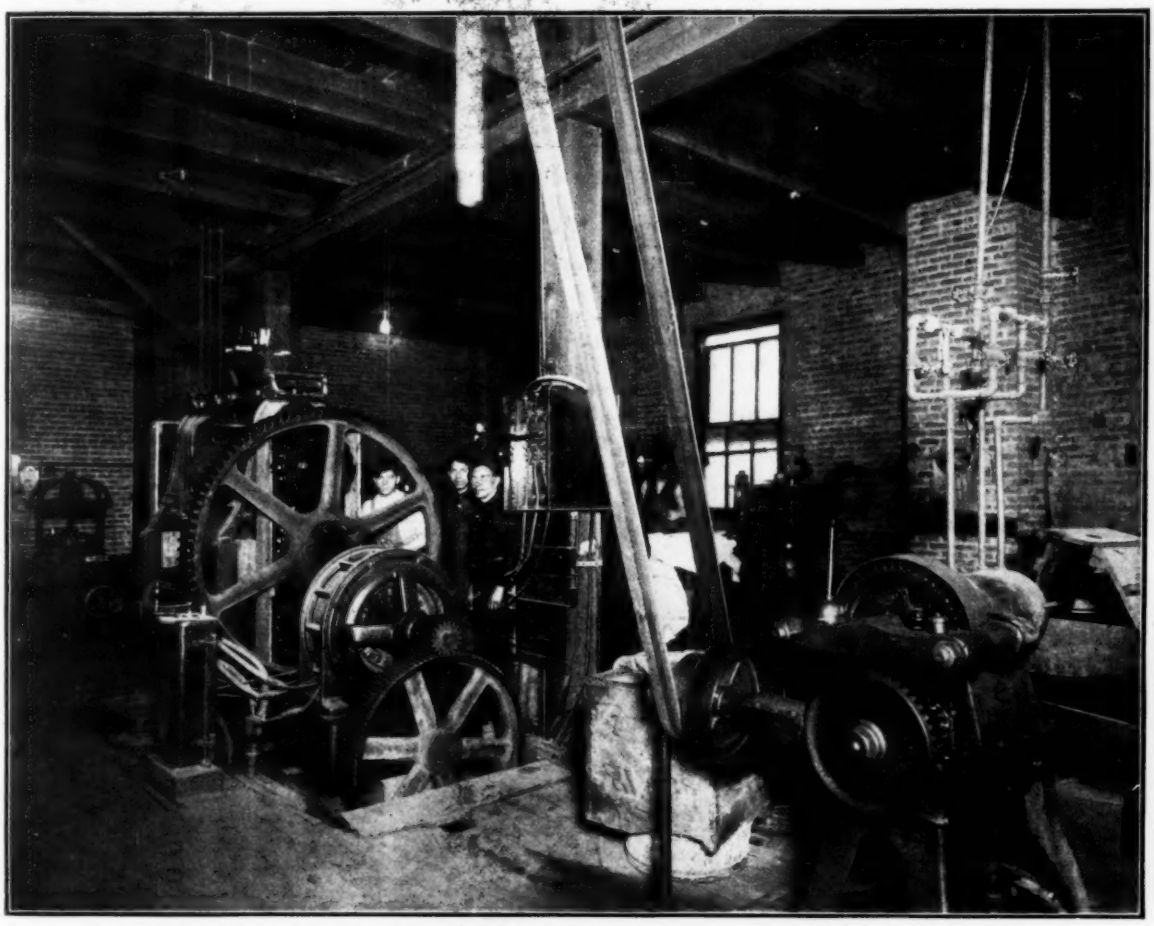
President Bond to Address Philadelphia Section.

The next meeting of the Philadelphia Section of the Illuminating Engineering Society will be held under the auspices of Drexel Institute, on Saturday, February 7, at 8 p. m., at the Institute. President Bond, of the Illuminating Engineering Society, will deliver a lecture on "Light and How to Use It." Admission will be by card, which will be forwarded to every member of the Section.

Electricity in Rubber Mills.

Although steam in varying quantities is required in rubber manufacturing, central-station power is being used in several instances with excellent results. In other cases a portion of the power is purchased and the utility is in a position to demonstrate the advantages of reliability of service in case of an accident to the private plant. Data are given on several installations.

In discussing the application of electricity to rubber mills it should be explained that there are several subdivisions of this industry, comprising factories engaged in refining the crude rubber into salable shape, those refining the rubber and making it up into various products, such as tires, tubing and mechanical goods, and those engaged in the process of reclaiming rubber, that is, taking old worn out articles of rubber and extracting the useful rubber remaining therein. While most of the processes involved in these various plants are common to all insofar as they go, there are special conditions that apply to each and must be considered separately when a motor installation is contemplated.



General View of Motor-Driven Machines in Vail Rubber Company's Plant, Chicago.

Due to the necessity of using steam in rubber manufacturing, the question of electric motor drive is only beginning to be recognized by rubber manufacturers as a factor of economy, and while there is an increasing number of plants replacing power-consuming line shafts with motors there is some hesitancy shown on the part of these companies to purchase power. The situation is, for comparative purposes, similar to candy manufacturing, breweries, paint manufacturing, laundries, etc., where, although steam in varying quantities is necessary, central-station power has demonstrated its superiority.

In many of the large rubber mills, however, it is frequently found that considered solely on the basis of cost central-station service cannot compete successfully with isolated-plant costs. Where such plants are found central stations should not ignore them as hopeless prospects but an effort should be made to supply part power for operation on certain days of the week, for instance; for overtime service; or for operating additional machines that may be added from time to time as the plant grows. Considerable of the business can be secured if the utility companies make only a reasonable charge and in a number of such instances profitable business results.

However, of greater importance than the immediate revenue realized is the fact that in case of a breakdown to the isolated plant (usually a frequent occurrence), or any emergency, the central station will be able to demonstrate in a convincing manner that cost is secondary to reliability of service.

Rubber manufacturers, as a class, are more or less reticent regarding the power required by the various machines used in their establishments and, in fact, considerable secrecy surrounds the entire industry from the manufacturing standpoint. Very little data on power requirements and motor characteristics are therefore available but in any event specific details would be of little value because of the special machines used. There has, however, been presented before a recent convention of American Institute of Electrical Engineers a paper by C. A. Kelsey, dealing with electrical requirements of certain machines in the rubber industry, principally the machines which work up crude rubber and render it suitable for the manufacture of various articles. These machines are more or less common to all rubber mills and the data are therefore extremely valuable. (*Transactions*, American Institute of Electrical Engineers, XXXII, page 1599).

35-Horsepower Motor Geared to Calender, Vail Rubber Company.

The principal source of rubber is the wild trees of Brazil, although cultivated rubber in increasing quantities is now produced in East India, Ceylon, Malayan Peninsula and Southern Mexico. The former reaches the factory in the form of balls or biscuits about a foot in diameter. Cultivated rubber is universally washed and sheeted at the plantation and is shipped in the form of cakes or folded sheets.

After the biscuits have been cut into chunks and softened in a bath of warm water, they are fed into a cracker or rough washing mill. This mill consists of two or three rolls between which the rubber passes, is torn apart and rolled out into a rough sheet. Water flowing through the rubber in its passage through the rolls washes out part of the entrapped dirt.

These mills run at a constant speed of 20 to 25 revolutions per minute. The load is very irregular and depends upon the feeding of the mill. A three-roll washer with continuous feeding requires an average of 25 to 35 horsepower with power peaks of 100 horsepower.

The rough sheet is then passed through a single set of rolls where it is further washed and rolled out into a sheet or "crepe."

35-Horsepower Motor Geared to Mixer, Vail Rubber Company.

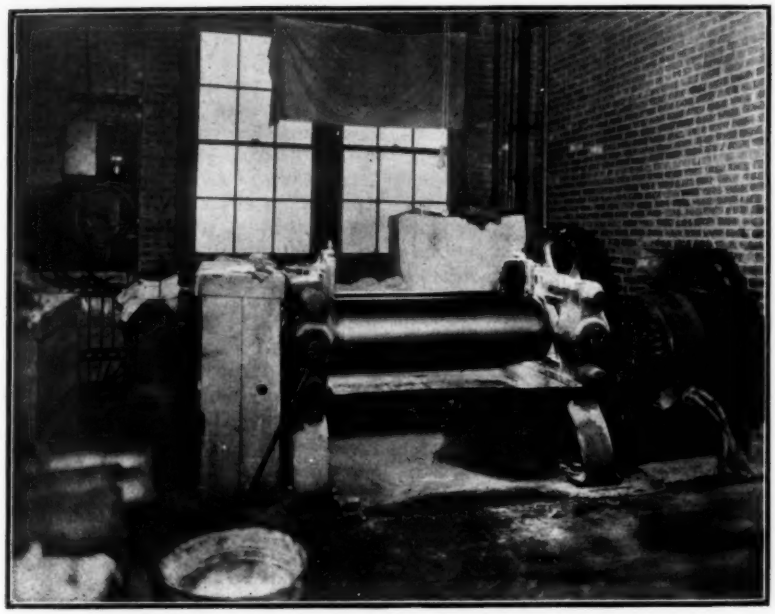
These mills run at a constant speed or about 25 revolutions per minute. The load is fairly uniform as the rubber is already in the form of a rough sheet. The power required averages 20 to 25 horsepower and occasionally runs up to 50 horsepower when the sheet is introduced between the rolls after being doubled.

After the crepe has been dried in a drying room where it is suspended from the ceiling or placed in a vacuum drier, it is ready to be masticated and mixed with the suitable ingredients to form various compounds.

The dried crepe must be worked or masticated into a homogeneous and plastic state before the ingredients are added. This is most economically done in a shorter mill than a mixing mill. The power required at the begining of the process is greater than at the end and runs up to high value as the rubber is cut free from the roll and doubled back in again. From tests on a 50-inch face mill the average power was 37 horsepower and the maximum 74 horsepower, while a 60-inch face mill required an average power of 90 horsepower and maximum of 140 horsepower.

Pure rubber is never used in the manufacture of rubber articles without first adding to it some other substance, Different materials are employed depending upon the use and desired characteristics of the rubber product. Some materials increase the elasticity, some impart hardness and toughness and some act as mechanical fillers to cheapen tht product without materially affecting the desired characteristics.

Where the rubber is masticated in the mixing mill, the predetermined weight



35-Horsepower Motor Geared to Refiner, Vail Rubber Company.

of the various substances are added in a powdered or liquid state only after the masticated rubber has been thoroughly worked and warmed. As the ingredients impart different degrees of hardness and toughness to the final product so will the power to drive the mill vary.

The speed of the rolls ranges from 20 to 25 revolutions per minute. A 40-inch face mill requires about 20 horsepower average and 40 horsepower maximum on relatively soft compound and 25 horsepower average and 55 horsepower maximum on hard compound while a 60-inch face mill requires 55 horsepower average and 120 horsepower maximum on medium compound.

In some installations the compound after leaving the mixing mill is passed through machines that strain it and reduce it to a very thin sheet. The strainers are in principle like a meat grinder. A feed screw revolving inside a water-jacketed cylinder forces the compound through a fine mesh screen which is backed up by a perforated plate. This removes all solid foreign objects which ordinarily find their way into the material. The compound becomes heated more or less as it passes through the strainer and the final temperature must be kept below a given value. The heating varies with the compound and the initial temperature. An efficient means of maintaining maximum output is to vary the speed. This therefore requires an adjustable-speed motor. A two-to-one speed range is sufficient. The power required is 25 horsepower over the whole range. The harder compounds, requiring high torque are run at the slow speeds and the soft compounds requiring less torque are run at the high speeds.

After passing through the strainers the compound is passed through a refiner which is a small mill whose rolls are held very close together. The compound is run through at a thickness of approximately three mills, being passed through several times and finally scraped off the roll as it comes through. It is then bundled up and is ready for the warming mill.

The mills are run at constant speed and uniform load. The power required does not exceed 25 horsepower.

Although the compound is warmed in the mixing mills, it cannot always be used at once in the calenders and, moreover, it is beneficial to the compound to let it season before calendering. Warming mills are therefore essential to warm the compound when it finally comes to the calenders. These mills are identical with the mixing rolls excepting they are equipped with steam heated rolls. The power required is slightly less than for the mixing rolls.

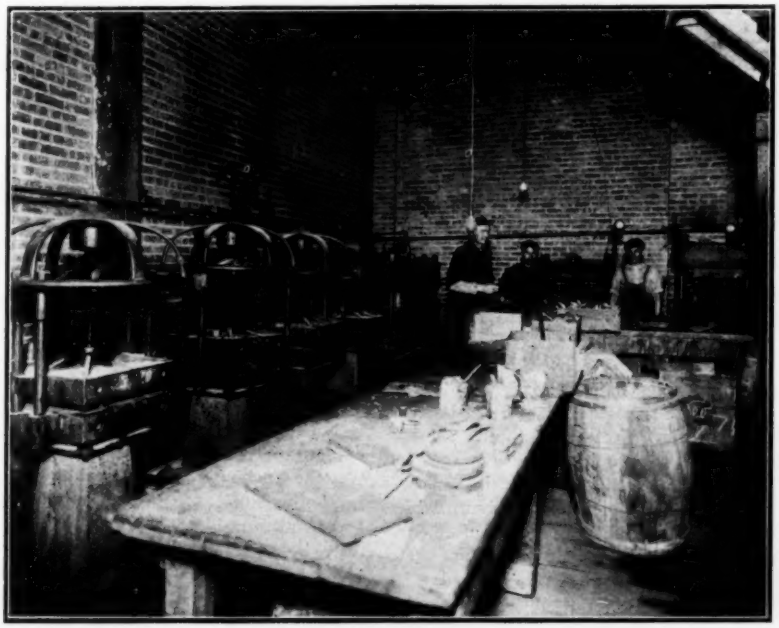
When the article to be produced is tubular or ringed shaped the compound is forced through tubes. This machine is similar to a strainer excepting that instead of a screen and perforated plate the machine is fitted with a disk which delivers the compound in the form of a tube.

The speed and power requirements approximate those of a strainer.

Practically all rubber compounds with the exception of those run through tubes and for the manufacture of mold articles are sheeted in a calender.

This machine has a series of rolls two or four in number arranged one over the other between which the compound is passed to form a sheet. The surface of the rolls is finished smooth and the space between the rolls is adjustable to a very fine degree. The rolls are fitted with steam and water connection to heat or cool the compound as required.

The power required to drive a calender varies over a wide range, depending on the character of the compound, thickness, width and speed. The speed is limited to that at which the compound can be run without blistering or the forming of a rough surface. When



Steam Presses, Vail Rubber Company.

the calender is started up with cold rolls the permissible speed is higher than after the cooling rolls become heated. As these rolls become heated, it is necessary, in order to obtain the desired surface of the sheet, to reduce the speed. A fine speed graduation is therefore necessary to maintain a maximum output. The torque required depends upon the thickness and material and there are so many combinations possible together with the speed requirements that it is difficult to formulate any rule to determine the power. The motor must be large enough to meet the extreme conditions.

From a number of tests made it is found that an 18-inch diameter, 40-inch face, three-roll calender running at a surface speed of 37 feet per minute, requires an average of 20 horsepower. A 24-inch diameter, 48-inch face three-roll calender running at a surface speed of 35 feet per minute requires an average of 35 horsepower and a 22-inch diameter, 65-inch face, three-roll calender running at a surface speed of 36 feet per minute requires an average of 45 horsepower.

Some compounds that are run through the calender in successive layers which build up to 0.5-inch or even 0.75-inch must be run at approximately 20 feet per minute while for "friction" work the speed of the driven roll may be 80 feet per minute. The thick sheets will require slightly greater torque than the average thickness while the torque for so-called "friction" work is considerably less.

The term frictioning is applied to that process performed by a calender in forcing a soft-rubber compound into the meshes of cotton fabric. It is preliminary to the skimming or coating of the fabric. The rubber compound is very soft and plastic and is rubbed in by the action of the driven roll which travels at a faster speed than the roll carrying the fabric.

As the compound and fabric are fed through in a continuous sheet the power required for a given material, thickness and width is quite uniform.

In considering the power and speed requirements of the different machines, it is seen that the mills for working up the rubber and mixing it to form the various compounds, call for extreme overloads but for short duration. By grouping these mills and driving by a single motor the load peaks can be reduced. Instead of the maximum values being 200 per cent of the average, it has been determined that this can be reduced to 150 per cent by driving with one motor a group of six mills used for masticating, mixing and warming.

Where individual drive is used, alternating-current polyphase squirrel-cage motors are best suited to carry the high load peaks. By grouping the mills, a motor of a smaller capacity than the aggregate of the individual motors can be employed. Moreover, synchronous motors can then be installed and assist in correcting the power-factor of the general power load. The mills are generally equipped with jaw clutches which can be open or closed while the shaft is running. The synchronous motor can thus be disconnected from the mills at starting. The selection of squirrel-cage or wound-rotor induction motors depends upon the local starting restrictions, as the squirrel-cage motor will easily bring the shaft up to speed even with all mills connected.

Direct-current motors are sometimes used when this is the power available but they are more expensive and not so well suited to the load conditions.

The calenders, as mentioned, require close speed control over a range of four to one. This can best be accomplished by a direct-current motor, which is the general practise. A number of schemes have been employed to accomplish this. Among them might be mentioned the multi-voltage and adjustable voltage methods.

The motor is excited at constant field strength and the armature supplied with a variable voltage. This variable voltage can be produced by a series of different voltage generators or by a rotary compensator or booster set.

A modification of the preceding is a three-wire, two-voltage source of armature supply combined with adjustable speed by field control. The first mentioned methods produce a wide speed range but are expensive because of the number of machines required for each calender. The second method produces a less speed range but is less expensive, particularly where a large number of calenders are installed.

With the more recent general application of commutating poles to direct current motors a greater speed range is permissible with constant armature voltage and varying field strengths.

This last mentioned method results in the simplest equipment as a whole. The motor must be larger but therefore more substantial, while the control can be made extremely simple, or it can be made entirely automatic, thus calling for a minimum of attention and care from the operator.

The tubers also require a direct-current motor and the last mentioned method of speed control is particularly adapted to these machines.

As the power to drive the mills is by far the greatest portion of the total power, alternating current will generally be selected. This therefore requires a motor-generator set or synchronous converter to deliver direct current to the calenders and tubes. These machines can be used to correct the power-factor of the general power circuit.

As the motors to drive the mills are run at constant speed, starting devices are only required. A speed controlling device must however, be furnished with the motors driving the tubers and calenders. The former machines are simple in operation and a controller for hand operation which combines starting and speed adjustment is sufficient. The calenders however, require closer attention and must be capable of starting and stopping by the simplest means on the part of the operator. This is best met by a control which enables the operator to bring the calender up to speed by moving the controller handle around to obtain the desired speed. Automatic acceleration should be provided to limit the current input while the controller handle is being moved around. It should then be possible to shut the calender down by pushing a button located on the calender. The speed of the calender should be retarded by dynamic braking of the motor. This is to provide a safety feature in respect to the operator in case his hand should be caught between the rolls. Also, it is desirable to stop quickly to save material otherwise wasted by the coasting of the motor. It should then be possible to bring the calender up to the same speed as before by pushing a button on the calender. Means should be provided for reversing the direction of rotation of the motor to assist in manipulating the calender and also in case anything should be caught between the rolls and it becomes necessary to back it out. The control should also include overload and low-voltage release features.

Pittsfield Company Extends Street Lighting.

The Pittsfield Electric Company, Pittsfield, Mass., has voluntarily agreed to supply current to the 1,100 incandescent and 150 arc lamps used in city lighting a longer time in the morning hours than they have hitherto burned. It has been the practice to turn off the street lights at 15 minutes before sunrise, but under the new arrangement the company will keep them burning until about 6:40 a. m.

Holyoke Rates Reduced.

The electric lighting rates in Holyoke, Mass., will be reduced about 20 per cent beginning February 1, according to an announcement of the Municipal Lighting Commission. It is stated that the Commission will enter the power field, overtures being made to manufacturing plants in the vicinity to obtain current from the Holyoke plant.

Rubber Mill Data.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Rubber mill manufacturing all kinds of mechanical rubber goods, rolls, inner tubes, solid tires, novelties and special devices. The output of the mill varies. Running hours per week, 60.

Total connected horsepower, 115. Total number of motors installed, 5. Average kilowatt-hours per month, 3,420.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-Hours	Month	Kilowatt-Hours	Month	Kilowatt-Hours
January	3,500	May	3,000	September	3,900
February	3,500	June	3,400	October	3,300
March	3,700	July	2,800	November	3,700
April	3,500	August	3,600	December	3,200

Load-factor, 5.4 per cent; operating-time load-factor, 12 per cent.

Motor Installation

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	35	600	Back-geared to a Birmingham rubber calender.
1	35	600	Back-geared to grinder or refiner, rolls 18 by 20 inches, speed-driving roll 20 revolutions per minute, other roll 16 revolutions per minute.
1	35	600	Back-geared to a mixer with rolls 15 inches in diameter and 50 inches long, operated at a speed of 16 and 20 revolutions per minute.
1	15	1,120	Geared direct to a Royle No. 3 perfected tubing machine.

All motors installed in this plant are of the squirrel-cage induction type.

Rubber tire factory, manufacturing a complete line of inner tubes and casings for automobiles, bicycles, etc. Plant operates 60 hours per week. Squirrel-cage induction motors are used exclusively.

Total connected horsepower, 300. Total number of motors installed, 9. Average kilowatt-hours per month, 22,368.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-Hours	Month	Kilowatt-Hours	Month	Kilowatt-Hours
January	12,752	May	19,677	September	26,532
February	19,668	June	23,593	October	27,844
March	20,909	July	24,446	November	24,130
April	21,780	August	23,162	December	23,918

Load-factor, 13.7 per cent; operating-time load-factor, 29 per cent.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
2	35	600	Each geared direct to rolls for preparing raw rubber for calenders.
1	100	720	Geared direct to a Birmingham rubber calender.
1	35	600	Geared direct to mixer, two rolls 15 inches diameter by 50 inches long, speed 16 and 20 revolutions per minute.
1	15	1,120	Driving by chain a rotary valve type, single-phase, dry-vacuum pump.
1	35	600	Back-geared to grinder, two rolls 18 inches by 20 inches, speed-driving roll 20 revolutions per minute, other roll 16 revolutions per minute.
1	15	1,120	Geared direct to a Royle No. 3 perfected tubing machine.
1	25	900	Geared direct to a Royle No. 2 perfected tubing machine.
1	5	1,120	Belted to line shaft driving machine-shop equipment; and buffing and grinding wheels for rubber working.

Rubber mill doing principally a jobbing business, that is, order work, although a limited line of inner tubes are also manufactured. Plant operates 60 hours per week.

Total connected horsepower, 75 Total number of motors installed, 3. Average kilowatt-hours per month, 3,057.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-Hours	Month	Kilowatt-Hours	Month	Kilowatt-Hours
January	2,130	May	2,850	September	4,540
February	2,360	June	3,060	October	2,810
March	2,570	July	2,800	November	4,530
April	2,570	August	3,430	December	3,030

Load-factor, 7 per cent; operating-time load-factor, 18 per cent.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	15	1,120	Belted to a line shaft driving one tubing machine; on small rubber lathe; and one double buffing and grinding stand.
1	25	900	Geared to mixer, rolls 15 inches diameter by 50 inches long.
1	35	600	Geared to rubber calender.

Commercial Practice
Management, Rates, New Business

House-Wiring Campaign at Columbus, O.

The Columbus (O.) Railway and Light Company some time ago began an extensive house-wiring campaign. A careful canvass of the city, recently completed, shows that there are 4,301 houses in Columbus where electricity is not in use. Hence the campaign.

In order to bring electric service within the reach of all the company has perfected an arrangement with the electrical contractors of the city whereby the work may be done and paid for on the installment plan—30 per cent of the cost on the completion of the work and 70 per cent in five monthly payments.

With the starting of the campaign the company will open its "new-business" department in commodious quarters at 104 North Third Street, and will conduct the work from there. The new department, which will include the old contract department, will be placed in charge of W. A. Wolls, who has been in the company's service for 15 years.

Details of a systematic plan of campaign, covering the entire city, have been perfected. Solicitors will be started out to visit the unwired homes. They will carry specimen plates showing standard electric fixtures of varying cost. Blank wiring applications will be sent out, showing each householder in minute detail how much it will cost him to wire each room.

"Many people have the idea that electrical wiring is very costly and it is to puncture this fallacy that we will conduct the campaign," an official of the company stated recently. "For instance, our solicitors will be able to show, through a brief computation, that the cost of wiring an average eight-room house is but $78, including the necessary fixtures."

Interesting pamphlets have been prepared, setting forth the attractive features of electric service, and calling attention to its safety, convenience, cheapness, cleanliness, beauty and brightness. One pamphlet takes up in detail the methods of wiring old houses with a minimum of trouble. Attention is particularly called to the multiplicity of labor-saving devices which are now open to use in homes where electric current is available.

Canvassers, in soliciting new business, will give the applicant the option of having the work done by any electrical contractor which he may select, of in turning the details over to the company. In the latter event the work will be split among all the electrical contractors of the city, a uniform price having been agreed upon.

"We believe that through the campaign we can bring comforts and economies of electricity to thousands of people," Rail-Light officials declared, in announcing their campaign.

Recreation Center for Boston Edison Employees.

The Edison Electric Illuminating Company of Boston is erecting three buildings and laying out grounds, for a recreation center, in connection with the new service station on Massachusetts Avenue, Boston. There will be a library, recreation building, and a combination dining hall and auditorium grouped on three sides of a square which will be given over to tennis courts and a putting green for clock golf. The buildings will be of terra cotta with cement-stucco finish, the inside finish being of scoured plaster and cypress. The fronts of the three buildings will be provided with ample piazzas which will be connected by means of a curving covered walk, the total length of this promenade being 683 feet.

The buildings and grounds will be under the management of a separate department, with a superintendent and corps of assistants. The center is for the use of the 1,900 employees of the Edison Company, who may have guests, and will furnish the advantages of a club, to which there will be no dues nor contributions. A restaurant, open continuously, will be a feature of the place, and there will be accommodations for entertainments and dances. a billiard and three pool tables, four bowling alleys, lounging rooms, shower baths, a writing room, game and committee rooms, and 13 sleeping rooms.

The employees of the company are scattered over the 700 square miles of the Edison territory, but some 500 will be employed in the service building, of which the recreation groups is a part, and the central location of this station makes it available to employees in all parts of the territory. The management will provide every facility for the fullest and most beneficial use of the center.

Growth of Muskogee Gas & Electric Company.

The Muskogee Gas & Electric Company was organized December 28, 1906, to take over the business of the Muskogee Electric & Gas Company and the Muskogee Ice & Power Company. The organization was perfected by H. M. Byllesby & Company and the property came under its management at that time.

The city and company have fulfilled all promises and predictions. In the seven years from January 1, 1907, to January 1, 1914, the population increased 50 per cent. As compared with this, the company's electric customers increased 173 per cent.

The company's gas output for the year 1907 was 448,378,000 cubic feet. For the calendar year just ended it was 1,683,437,000 cubic feet, an increase of 274 per cent. For the same period the company's electric output increased from 2,810,000 to 5,661,000 kilowatt-hours, an increase of 101 per cent. From an electric station capacity of 1,540 kilowatts, improvements, extensions and additions from time to time have increased the capacity to 4,000 kilowatts. The company's connected load comparison in detail follows:

	1913	1907	Increase	Per Cent Increase
Customers	3,256	1,190	2,066	173
Kilowatts lighting load	4,021	949	3,072	323
Horsepower in motors	2,453	478	1,975	413
Total connected kilowatts all purposes	6.056	1,373	4,683	341
Miles pole line	77	21.2	55.8	263
Population per meter	9.3	17	.....	...

California Towns Lower Rates.

A reduction in electric rates from eight to seven cents a kilowatt-hour for Los Angeles, Riverside, San Bernardino, Orange and Kern counties, but not including Los Angeles city, effecting a saving to electric consumers of approximately $250,000 a year, was declared on January 6 by the Southern California Edison Company.

The reduction is the second made by the company, the first being declared about a year ago when a maximum rate of eight cents was declared, reducing the rate from nine and 10 cents per kilowatt-hour and effecting a saving at that time to consumers of about $240,000 a year.

AN ACCOUNTING SYSTEM FOR SMALL CENTRAL STATIONS.[1]

By H. G. D. Nutting.[2]

The purpose of this paper is to show forms and methods to be used by the busy plant operator who fills every position from manager to meter man. It applies particularly to the requirements of the Wisconsin Railroad Commission but can be used with some modifications in other states. The data given are the result of the development of a system in an actual central station, modified in accordance with the opinion and judgment of accountants in larger central stations.

Accounts are kept for three reasons: (1) to show the condition of the business at any time; (2) to show its tendencies; and (3) to detect fraud.

Only simple, short methods should be used making the complete and accurate record of a transaction in the shortest time possible and with the smallest amount of work.

The "objective system" is recommended. That is,—using original memoranda and vouchers, and filing them as permanent records of the transaction.

The Shannon No. 12 filing case and clip is used for all filing. The following filing cases are required.

(1) Monthly and Yearly Reports. (File by dates.)

(2) Invoices Unpaid and Paid. (File separately, alphabetically and by dates.)

(3) Purchase Orders Filled and Unfilled. (File separately, alphabetically and by dates.)

(4) Cancelled Check File. (File alphabetically by dates.)

(5) General Transaction. (Journal, Day Book and miscellaneous entries of controlling accounts). One file case for each month. File by dates and number sheets at end of month.

So far as the accounting records are concerned, the ultimate object is to facilitate the making up of the annual Railroad Commission report.

All forms are based on and designed to work to the making of the monthly report, the recapitulation of which makes up the Railroad Commission report. The monthly report is shown by forms 1, 2, 3, 4 and 5. In order to show the working of the forms complete, they are provided for a combination electric and water plant. The monthly report consists of:

(1) Income account; (2) balance sheet; (3) detailed report of income and expense; and (4) statistical sheet. It also provides for: (a) monthly statement of income or deficit; (b) disposition of net income; and (c) monthly statement of accounts receivable. Each account is given a number and all entries made by number.

Some accounts are included that need not be kept in the divided form shown on the report, particularly in Class C plants. In any particular case these can be combined into one. The same is true of the statistical data.

Service Ledger.

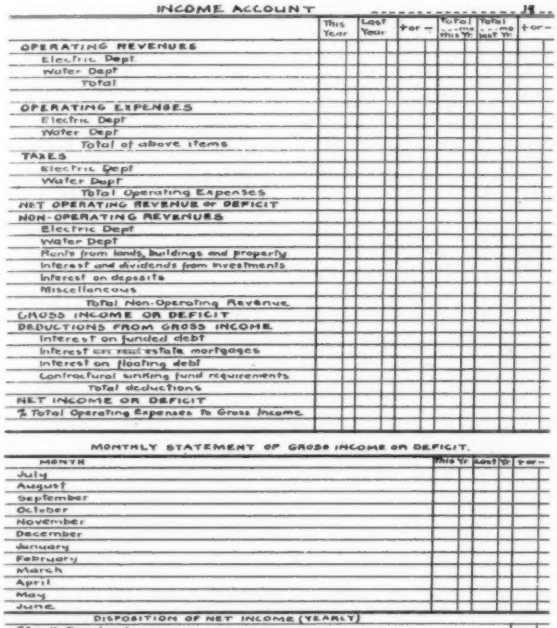
A proper record of the service earnings and their sources is essential. The consumer's service ledger is the book provided for this purpose. There are nearly as many forms of consumer's ledger as there are utilities. In general their make up may be based on (1) names; and (2) premises.

If based on names they may be arranged alphabetically or routed. If on premises they are usually routed. On account of the fact that, when a consumer moves, the premises data remain the same, the premise basis is recommended.

The consumer's ledgers may be, (a) horizontal; or (b) vertical. The horizontal ledger is one whose consecutive monthly records continue in a horizontal line and throughout several pages as the year proceeds. The vertical ledger is one whose consecutive monthly records continue in vertical columns. Usually one sheet will take care of four years, two years on each page.

In the horizontal ledger one sheet may contain about 25 premise records. In the vertical ledger each sheet is the record of only one premise. The horizontal type has the advantage of a monthly check. Also a greater number of accounts can be conveniently handled. It is therefore recommended. The vertical type cannot be checked monthly, but can be checked yearly.

Form 17 and 18 shows the ruling for the horizontal ledger designed for combination plants. Utilities having only one department can either leave


INCOME ACCOUNT 19..

	This Year	Last Year	+ or −	To Tot. — mo. this Yr.	To Tot. — mo. last Yr.	+ or −
OPERATING REVENUES						
Electric Dept						
Water Dept						
Total						
OPERATING EXPENSES						
Electric Dept						
Water Dept						
Total of above items						
TAXES						
Electric Dept						
Water Dept						
Total Operating Expenses						
NET OPERATING REVENUE or DEFICIT						
NON-OPERATING REVENUES						
Electric Dept						
Water Dept						
Rents from lands, buildings and property						
Interest and dividends from investments						
Interest on deposits						
Miscellaneous						
Total Non-Operating Revenue						
GROSS INCOME OR DEFICIT						
DEDUCTIONS FROM GROSS INCOME						
Interest on funded debt						
Interest on real estate mortgages						
Interest on floating debt						
Contractural sinking fund requirements						
Total deductions						
NET INCOME OR DEFICIT						
% Total Operating Expenses to Gross Income						

MONTHLY STATEMENT OF GROSS INCOME OR DEFICIT.

MONTH	This Yr.	Last Yr.	+ or −
July			
August			
September			
October			
November			
December			
January			
February			
March			
April			
May			
June			
DISPOSITION OF NET INCOME (YEARLY)			
Stock Dividends			
Other Payments			

Form 1, Income Account.

BALANCE SHEET 19...

ASSETS	Total	Elec.	Wat.	LIABILITIES	Total	Elec.	Wat.
PROPERTY and PLANT				CAPITAL			
Cost previously recorded				Stock, Pref			
Additions during period				" Common			
				Funded debt			
TREASURY SECURITIES				MORTGAGES			
Treasury stock				Real estate			
Treasury Bonds				others			
Bonds certd and not issued							
INVESTMENTS				CURRENT LIABILITIES			
Securities in other Co's				Notes and Bills Pay			
Other investments				Accts Pay			
				Mat Int on fund. Debt unp			
				" " " Bills Pay			
RESERVE and OTHER FUNDS				Dividends Unpaid			
				Deposits			
				Sundry Current Liab.			
CURRENT ASSETS				ACCRUED LIABILITIES			
Cash				Insurance Accrued			
Notes and Bills Rec				Taxes Accrued			
Accts Rec (Detailed)				Unmat Int on fund Debt Accd			
Accts Rec (Sundry)				" " Bills Pay			
Int. and Div. Rec.				Dividends Accrued			
Materials and Supplies				Sundry Accrued Liabil			
Sundry current assets							
PREPAID ACCOUNTS				RESERVE and SINK. FND LIAB			
Prepaid Insurance				Depreciation Reserve			
Prepaid Taxes				Bond Redemption "			
Prepaid Interest							
Sundry Prep'd Accts							
OPEN ACCOUNTS				OPEN ACCOUNTS			
Deficit beging of year				Surplus beginning of year			
" current fiscal year				" current fiscal year			
" for period of report				" for period of report			
TOTAL				TOTAL			

MONTHLY STATEMENT OF ACCOUNTS RECEIVABLE

	Total		Electric		Water	
	Service	Sundry	Service	Sundry	Service	Sundry
Balance first of month						
Sales this period						
Total						
Cash Received						
Allowances						
Total						
Still Outstanding						

Form 2, Balance Sheet.

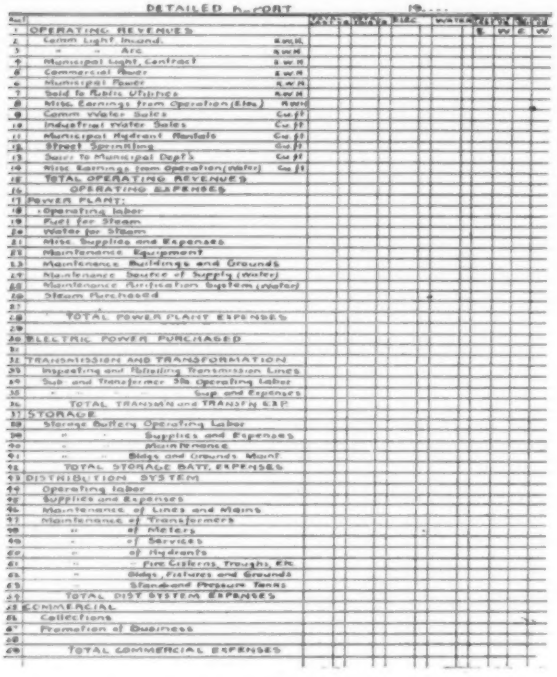
1 A paper presented before the recent convention of the Wisconsin Electrical Association.

2 Assistant to the president, Clement C. Smith properties.

the unnecessary columns blank or omit them entirely in ruling. Manifestly omitting them entirely will reduce the size of the covers.

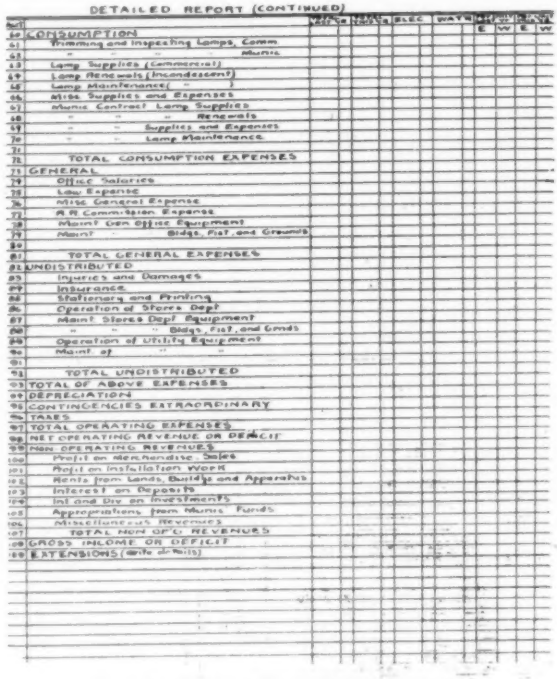
The consumer's ledger form shown provides for the entering of the premise number as a basis for billing. The next column provides for the entering of five names of succeeding consumers who may live in a given premise. This makes it possible to route the accounts, thus facilitating billing from the meter reading books. At no time in the process is it necessary to shuffle meter-reading sheets, bills or consumers ledger sheets.

Attention is called particularly to some features of this form, which are the invention of George Allison, and which have made it convenient and practical. One is the provision for taking care of new accounts without disturbing the order of routing. Each page is ruled for 25 accounts. Only 20 of these are filled out, the other 5 being left blank for new accounts. When a new consumer is connected between any two present consumers, the premise number is written in one of the five extra spaces at the bottom of the sheet and its line (or account) number inserted on the line between the two accounts where it should have


DETAILED REPORT 19...

Acct			Water	Gas	Elec	Water	Gas	Elec
						$	W	E	W
1	OPERATING REVENUES								
2	Comm Light, Incand.	K.W.H.							
3	" " Arc	K.W.H.							
4	Municipal Light, Contract	K.W.H.							
5	Commercial Power	K.W.H.							
6	Municipal Power	K.W.H.							
7	Sold to Public Utilities	K.W.H.							
8	Misc. Earnings from Operation (Elec)	Meters							
9	Comm Water Sales	Cu. ft.							
10	Industrial Water Sales	Cu. ft.							
11	Municipal Hydrant Rentals	Cu. ft.							
12	Street Sprinkling	Cu. ft.							
13	Sales to Municipal Dept's	Cu. ft.							
14	Misc. Earnings from Operation (water)	Cu. ft.							
15	TOTAL OPERATING REVENUES								
16	OPERATING EXPENSES								
17	POWER PLANT:								
18	Operating labor								
19	Fuel for Steam								
20	Water for Steam								
21	Misc. Supplies and Expenses								
22	Maintenance Equipment								
23	Maintenance Buildings and Grounds								
24	Maintenance Source of Supply (water)								
25	Maintenance Purification System (water)								
26	Steam Purchased								
27									
28	TOTAL POWER PLANT EXPENSES								
29									
30	ELECTRIC POWER PURCHASED								
31									
32	TRANSMISSION AND TRANSFORMATION								
33	Inspecting and Patrolling Transmission Lines								
34	Sub and Transformer Sta Operating Labor								
35	" Supp and Expenses								
36	TOTAL TRANSMN and TRANSFN EXP.								
37	STORAGE								
38	Storage Battery Operating Labor								
39	" " Supplies and Expenses								
40	" " Maintenance								
41	" " Bldgs and Grounds Maint								
42	TOTAL STORAGE BATT. EXPENSES								
43	DISTRIBUTION SYSTEM								
44	Operating Labor								
45	Supplies and Expenses								
46	Maintenance of Lines and Mains								
47	Maintenance of Transformers								
48	" " of Meters								
49	" " of Services								
50	" " of Hydrants								
51	" " Fire Cisterns, Troughs, Etc								
52	" " Bldgs, Fixtures and Grounds								
53	Standard Pressure Tanks								
54	TOTAL DIST SYSTEM EXPENSES								
55	COMMERCIAL								
56	Collections								
57	Promotion of Business								
58									
59	TOTAL COMMERCIAL EXPENSES								

Form 3, Detailed Report.


DETAILED REPORT (CONTINUED)

Acct			Water	Gas	Elec	Water	Gas	Elec
						E	W	E	W
60	CONSUMPTION								
61	Trimming and Inspecting Lamps, Comm								
62	" " " Munic								
63	Lamp Supplies (Commercial)								
64	Lamp Renewals (Incandescent)								
65	Lamp Maintenance (" ")								
66	Misc Supplies and Expenses								
67	Munic Contract Lamp Supplies								
68	" " " Renewals								
69	" " " Supplies and Expenses								
70	" " " Lamp Maintenance								
71									
72	TOTAL CONSUMPTION EXPENSES								
73	GENERAL								
74	Office Salaries								
75	Law Expense								
76	Misc General Expense								
77	R R Commission Expense								
78	Maint Gen Office Equipment								
79	Maint " " Bldgs, Flat, and Grnds								
80									
81	TOTAL GENERAL EXPENSES								
82	UNDISTRIBUTED								
83	Injuries and Damages								
84	Insurance								
85	Stationery and Printing								
86	Operation of Stores Dept								
87	Maint Stores Dept Equipment								
88	" " " Bldgs, Flat, and Grnds								
89	Operation of Utility Equipment								
90	Maint of " "								
91									
92	TOTAL UNDISTRIBUTED								
93	TOTAL OF ABOVE EXPENSES								
94	DEPRECIATION								
95	CONTINGENCIES EXTRAORDINARY								
96	TAXES								
97	TOTAL OPERATING EXPENSES								
98	NET OPERATING REVENUE OR DEFICIT								
99	NON OPERATING REVENUES								
100	Profit on Merchandise Sales								
101	Profit on Installation Work								
102	Rents from Lands, Buildgs and Apparatus								
103	Interest on Deposits								
104	Int and Div on Investments								
105	Appropriations from Munic Funds								
106	Miscellaneous Revenues								
107	TOTAL NON OPG REVENUES								
108	GROSS INCOME OR DEFICIT								
109	EXTENSIONS (write in Red)								

Form 4, Continuation of Detailed Report.

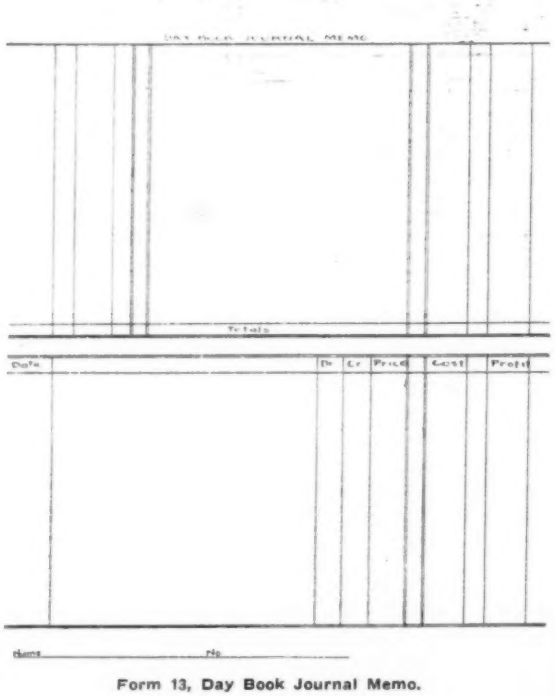
STATISTICAL RECORD 19...

MATERIAL and SUPPLIES Items	Acct	ELECTRIC Beginning of Period	Added	Subtracted	End of Period	WATER Beginning of Period	Added	Subtracted	End of Period
Fuel	01								
Power Plt Supplies	02								
Elec Line Material	03								
Water Dist Material	04								
Transformers	05								
Meters	06								
Incand Lamps	07								
Arc Lamps	08								
Misc Elec	09								
Misc Water	010								
Misc	011								
Total	012								

ELECTRIC DEPT	Daily Meter	Daily Watt	Per —
No Arcs beginning period (Comm)			
" " ending "			
" beginning (Munic)			
" ending "			
K.W.H. sold (on Arcs) (Comm)			
" " (Munic)			
Total K.W.H. per Arcs			
Incandescent Connected, K.W.			
" lamps			
K.W.H. sold (incand lgt) meters			
" flat rate			
" Total			
K.W.H. sent out			
No Comm lgts consumers			
" meters			
" flat rates			
K.W.H. consumption per consumer			
Population served			
K.W.H. consumption per capita			
H.P. Motors connected			
K.W.H. Sold for Power			
K.W.H. sent out for Power			
Unaccounted for Light K.W.H.			
" Power K.W.H.			
" Total			
No of Comm Power Consumers			
Consump per Power Cons. K.W.H.			
No of Power Meters			
" Flat Rates			
Receipts (or Comm lgt per K.W.H.)			
" Power			
" Street Ltg			
" per cons			
" per cap			
Ratio K.W.H. sold to sent out (lgt)			
" " " (Pow)			
" " " (Tot)			
Cost operation per K.W.H. sold			

WATER DEPT	Daily Meter	Daily Book	Per —
No Hydrants, beginning period			
" " ending "			
Ft of Mains beginning "			
Ft of Mains, Ending "			
No of Consumers, beginning "			
No of Consumers, ending "			
" " Meters, beginning "			
" " " ending "			
" " Flat Rates, beginning "			
" " Flat Rates, ending "			
Water Sold for Fires cu ft			
" " St Ltg "			
" " City Dept "			
" " Domestic Use "			
" " Industries "			
" " Misc Dept "			
Total Water Sold "			
Total Water Pumped "			
Unaccounted for "			
Ratio Com Sales to Com Consmrs			
Ratio Ind Sales to Ind Consmrs			
Ratio Total Sales to Total "			
Populations Served			
Ratio Total Sales to Population			
Ratio Total Pumpage to "			
Ratio use for Fires			
" St Ltg			
" Misc			
Cost of Pumping (Power pt of Plant)			
Are Domestic Pressure Tanks			
" Fire			
No of Fires			

Form 5, Statistical Record.


DAY BOOK JOURNAL MEMO

Totals

Date		Dr	Cr	Price	Cost	Profit

Name No.

Form 13, Day Book Journal Memo.

CHARGE | CREDIT | TRIPLICATE

Acct | Amt | Acct | Amt

Date _____

NAME | Hrs | Credit | Remarks

Name _____ Address _____

Items | Price | Cost | Profit

Form 8, Credit Memo. for Supplies.

—BILL—
MODELTOWN ELECTRIC COMPANY
Modeltown, Wis
JANUARY 1914.
Bills For Last Discount Day Feb. 10, 1914.

Name.....
Address.....

Do Not Detach
Ledger Page..... Line.....

Gross | Dis. | Net

Metered Light 1
Meter Reading
Meter Reading
Difference X = K.W.H.
Delinquent For

Flat Rate Light 4
Watt Lamps @ ¢ Per Mo.
Watt Lamps @ ¢ Per Mo.
Watt Lamps @ ¢ Per Mo.
Delinquent For

Power 2
Meter Reading
Meter Reading
Difference X = K.W.H.
Delinquent For

Water 3
Meter Reading
Meter Reading
Difference X = Cu. Ft.
Delinquent For

Total of Above
Merchandise and Sundry
Total Bill

Total Above
Sundry
Total

Received Payment
MODELTOWN ELECTRIC CO.
Per.....
Date.....

Date Paid.....

Form 9, Customer's Bill.

P.O. No..... Date.....

To.....Street.....

City.....State.....

Please Deliver Not Later Than.....The Following Goods By Freight Express, (Collect or Prepaid), Mail, Parcels Post, Messenger, and charge to Our Account.

Items | Price | Rec'd Date | Rec'd Amt

Mark Our Order No. on all Packages.

.....Electric Company

Per.....

City.....State.....

Form 10, Purchase Order.

been. This scheme can be extended further by carrying over the additions to the last page of a certain district. Then, when recording the bills in the consumer's ledger, those not appearing on the page in accordance with their normal routing, are thrown out and entered in a group on the page at the end of the particular district.

Another feature is the novel scheme for taking care of current month discounts. The net-bill columns are numbered and these numbers carried to the "current month discount" column so that any discount entry can be identified with its principle. Inspection of the form will show how this is done.

The use of the consumer's ledger goes hand in hand with billing for service. The methods of doing this are based on the meter reading sheet. (Form 11.) The meter reading sheets

No. _____ Original Date _____

Bought of
MODELTOWN ELECTIC COMPANY

Name _____ Address _____

Items | Price

Do Not Detach

No. _____ Date Paid _____

Forms 6 and 7, Bill for Supplies.

are of different color for each department and are arranged in route books, the number of route books depending on the size and arrangement of the city. When the meter books are brought in the method of procedure is as follows: (1) Calculate consumption and record on meter sheets; (2) figure bills but do not total; (3) transfer bills to customer's ledger; (4) enter delinquent accounts on bills; (5) transfer sundry accounts to service bills; (6) total each bill; and (7) add earnings from consumer's ledger net-bill column, enter on journal voucher memo, post to general ledger, charging accounts receivable and crediting earnings by departments.

The bills are now ready to send out. Several methods of placing the bills in the hands of the customer may be followed: (1) they may be delivered; (2) mailed in envelopes; or (3) mailed on post cards. Without discussing the advantages and disadvantages of each method, the first method is recommended in most cases.

Collections.

The bill forms recommended contemplate the use of the prompt-payment discount. It is generally conceded that this is the best scheme for collecting the majority of the bills.

One of the principal disadvantages

of billing and collecting as described and recommended in the foregoing arises out of the customer's failing to bring in his bill when he comes to pay. This necessitates the cashier's looking up his ledger page number and making out an entirely new bill. On last discount day this delays the speed of handling customers and makes some of them disgruntled. It is suggested that merely the total amounts owed be placed on the bills in such cases, leaving off the meter readings and consumption unless asked for by the consumer.

An alphabetical index of consumers, giving their ledger page numbers is essential. On account of its simplicity, a 3 by 5 card system is favored. Each card will state simply the customer's

METER DATA

Meter No.	Make	Co. No.	Date In	Reading	Date Out	Reading	Dial Const.

Load, Watts, Connected..... Active.....

Class.....

K.W.H. Per Mo. at Primary Rate.....

METER READING

Date 191	Reading	Diff	Consumption	Reader	Remarks

Location of Meter _____

Address _____

Leg P Line _____

Form 11, Meter Data.

name and ledger page number. Any other historical information regarding the customer may be placed thereon if desired. It has also been found that the customer can be trained to remember his ledger page number. This often facilitates the making out of bills.

Purchase Orders.

Form 10 is provided for purchase orders. These are put up in book form in two colors. The original is sent to the vender and the duplicate (carbon) left in the book. The orders are numbered consecutively. Every purchase of anything to be invoiced should be on a purchase order. This does not include petty cash purchases. Salesmen should not be permitted to make out orders on their own blanks. Each purchase order should state specifically what is wanted. Too much care cannot be exercised in making out orders. Often apparently small mistakes cost considerable money to rectify.

Purchase Invoices.

Vendors usually acknowledge orders. Upon receipt of acknowledgment by the purchaser it should be checked against the original order and placed on a spindle for future reference. It is not necessary to file or keep acknowledgments after the goods have been received. When the goods come in they should be checked against the duplicate purchase order. The duplicate purchase order should be kept in a "live file" till all goods are received, and moved to a transfer file when order is complete. This can be done in one file case.

There are several ways of handling purchase invoices. The following is recommended as one of the simplest. When the invoice comes in, record it on invoice record (Form 16) and place it in a file labeled "Unpaid Invoices," arranged alphabetically and file by date. In order to keep proper records of purchases every purchase should be charged to the proper account on the invoice record giving the total of each invoice and the account to which it is chargeable before the invoice is filed. The sum of this list, at the end of the month, will be charged through the day book journal to the ledger to the various accounts and credited to accounts payable. Purchase invoices should be discounted if possible, the largest discounts being taken first. In other words the "Unpaid Invoice" file should be kept nearly empty. All invoices should be paid by check (Form 12). The check shown is self explanatory. When cancelled and returned it acts as a receipt, and should be filed by date under the name of the payee. After the check is written its number should be recorded on the invoice it is meant to pay and the invoice filed alphabetically by date under "Paid Invoices." Invoices should always be completely paid if possible, i. e., payments "on account" should be avoided. If it is necessary to make a payment "on account" the date and amount can be recorded on the invoice and the invoice returned to the "Unpaid File." At the end of the month the check book stubs should be added and recorded on a day-book journal memo.

Deposit.....
Bal. Frd.....
Date..... No.....
To.....

MODELTOWN STATE BANK

No. _____ Modeltown, Wis. _____ 191_

Pay To The Order of _____ $ _____

	No or Date Inv.	Gross Amt.	Disc.	Net Amt.	No or Date Inv.	Gross Amt.	Disc.	Net Amt.

_____ Dollars

MODELTOWN ELECTRIC CO.

Per. _____ Title _____

No Other Receipt Required

Form 12, Voucher.

Post in the ledger the total to accounts payable, Dr., and to cash, Cr.

Stores and Supplies.

One of the hardest problems of the small-plant manager is taking care of his stores and supplies, on account of his inability to employ a storekeeper and still make it easy for all workmen to get stores quickly.

All transactions involving the sale or use of supplies or materials are recorded on forms 6, 7 and 8. This is put up in pads (or on autographic registers) having original, duplicate and triplicate. The various processes are as follows.

PETTY CASH DISBURSEMENTS _____ 191_

Date	Items	Acct No	Amt

RECAPITULATION

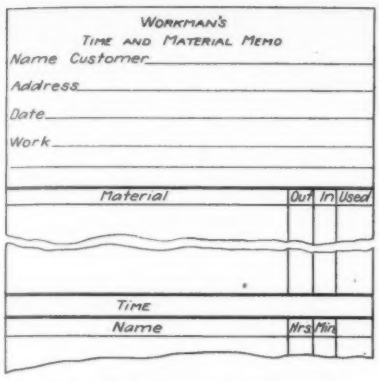
Acct															Total
Amt															

No._____

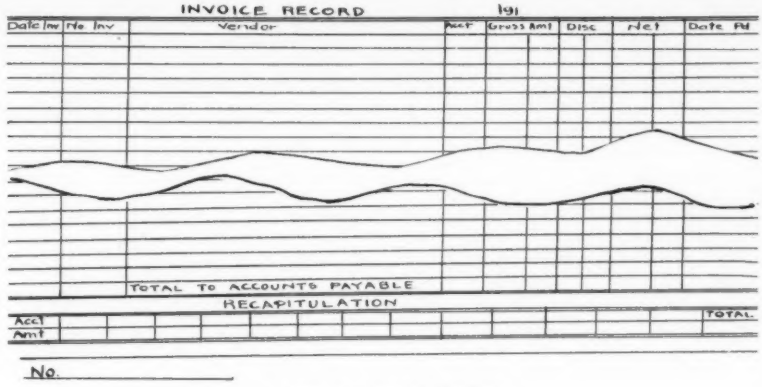
Form 14, Petty Cash Disbursements.

Cash Sale of Supplies From Store.

Enter items sold and its price on the original, writing the word "cash" in the blank provided for "name." In the average small plant it is necessary to use only the "triplicate" for this. Then several items can be put on one sheet. This of course requires a sheet (Form 8) to be removed from the pad in the morning of each day and kept in some



Form 15, Workman's Time Card.

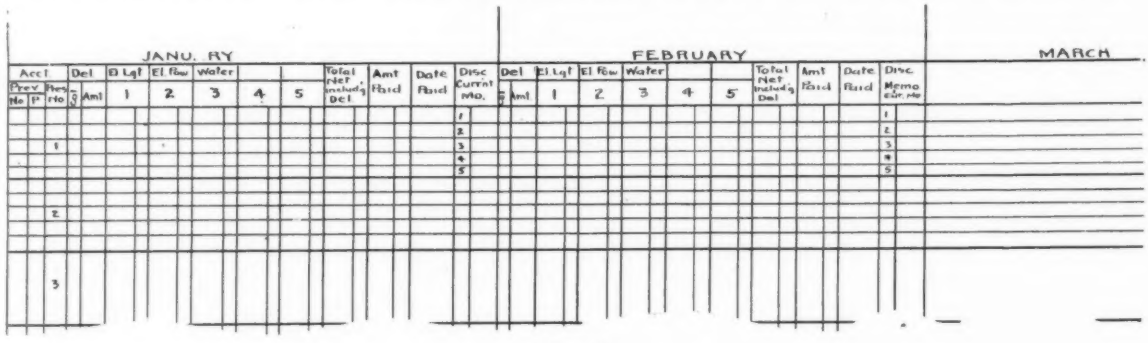


Form 16, Invoice Record.

convenient place for recording entries. The original and duplicate can be thrown away. At the end of the day the sheet is filed in the current month "general transactions" file.

Credit Sales From Store.

Use forms 6, 7 and 8. Write name of purchases on original and record items purchased. Insert price. Give purchaser original, which is his bill for the material. If he goes away without for the purpose. When posting cash stubs, remove duplicate from "Sundry Accounts Receivable Paid" file. Summarize stubs at end of day. Record on day-book journal voucher charging cash and crediting sundry accounts receivable. The duplicate is used only for memorandum purposes. The triplicate is filed in the "Current Monthly Transactions" file after entering the cost of the materials purchased and the they are to be charged to persons or expense accounts, are first recorded on workman's card (Form 15). This first record is made when the attention of the office is called to the necessity of doing the job. The job card is made out in original and duplicate. The original is retained in the office as a follow up. The duplicate is given to the workman as an order. All time and material used on a particular job is



Form 17.

it, mail it to him. The essential feature of collecting accounts receivable promptly is prompt billing.

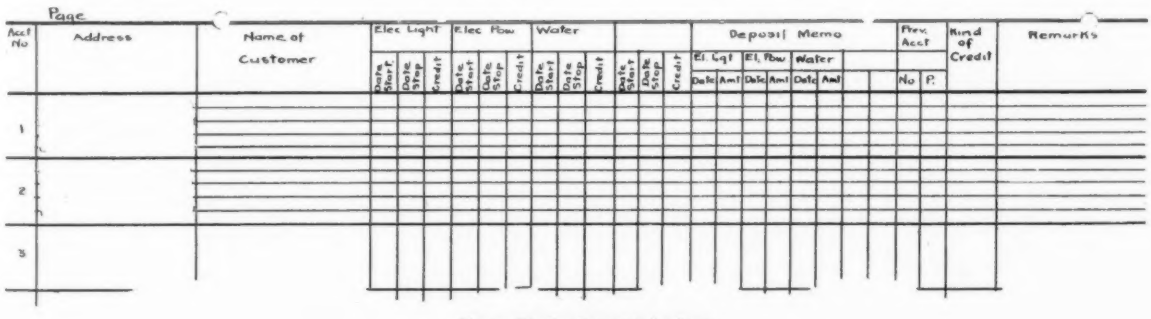
Retain duplicate in a file of "Sundry Accounts Receivable Unpaid." File alphabetically. When bill is paid, tear off "Cash Stub" at bottom. Put cash stub on daily receipts spindle and receipt bill (if customer brought it). If he did not bring it make him out another statement on a bill head provided profit charge sundry accounts receivable and credit the proper stock account and profit on merchandise sales.

This system contemplates the careful keeping of a price book which is not a difficult thing to do.

Credit Sales and Expense Account Charges.

This includes credit sales of both material and labor. All jobs, whether recorded on this card by the workman. When the job is done he turns in the card but it must not be carried beyond the end of the month. In case a job is not finished a new card must be made.

When the workman brings in a job card, the data it contains are transferred to form 6, 7 and 8. If chargeable to a personal account it is entered on the original and handled like an



Form 18, Customers' Ledger.

ordinary merchandise credit sale as previously explained. If chargeable to an expense account the original and duplicate are torn off and thrown away and the entries made only on the triplicate. The triplicate is then filed in the "current month transactions" file.

Any personal bills remaining in the "Sundry Accounts Receivable" file at the time of billing for service are entered on the service bills and this continued so long as they are unpaid.

Petty Cash Disbursements.

Petty cash disbursements are entered on Form 14. No separate "petty cash" fund is carried. All payments are made direct from main cash drawer and checked against income and outgo daily. As many items as possible are recorded on each "petty cash disbursement" sheet and recapitulated each day or when sheet is full. File in "Current Month Transactions" file.

Recording Cash Collections.

Each day several stubs are received, representing collections for service and sundry accounts. These are placed on a spindle at the moment of receipt. At the end of the day they are summarized, checked against the cash drawer and collected on Shannon double-file clips. At the end of the month they are added. Entry is then made on a day-book journal sheet charging cash and crediting respectively service accounts receivable and sundry accounts receivable.

Pay Roll.

All labor is recorded on job cards. power-house men and others working on only a few accounts are issued enough cards to cover those accounts. They turn them in at the end of the month and they are entered on Form 8 (triplicate). Each workman's name is placed on the sheet but his time is credited to accounts payable. At the end of the month each man's time can be recapitulated from the sheets. Check is written and the amount charged to accounts payable and credited to cash in the regular summing up of the check-book stubs.

Any excess in the price of labor over cost in job orders is credited to profit on wiring and installation on the individual sheets.

At the end of the month depreciation and other regular monthly entries are made on the day-book journal sheet. All transactions required for permanent history are filed in the "Current Month Transactions" file. When this is complete at the end of the month, all sheets are numbered and posting started. Convenience in posting is effected by means of a posting sheet. This is simply a long sheet ruled in as many columns as can be conveniently handled. No account numbers are printed in the columns but these are written in as required during the posting operation. A debit sheet and a credit sheet is required. Each is divided as to electric accounts, water accounts, and electric and water accounts. After posting and summarizing these sheets the totals are carried to the general ledger. After posting the regular forms of trial balance are taken off.

This paper is presented with the realization that it is not easy to discuss so much detail in a way it can be easily understood. The workings of most of the forms will require considerable deep thought. Those who are in daily contact with accounting problems may see some scheme or short cut which appeals to them.

Educational Work of the New York Edison Company.

Twenty-six pupils in the commercial school of The New York Edison Company have completed the prescribed courses with the rating that entitles them to the Edison "A" gold button recently presented to them by Arthur Williams, the company's general inspector. The badge represents a rating of 90 per cent or over in the two years' work prescribed in the company school. This, however, is open to all member companies of the New York Companies Section of the National Electric Light Association, and two of the recipients, Messrs. Leask and Montgomery, are members of the New York and Queens Electric Light & Power Company.

The first year's work covers courses in History and Development of Electricity; Elements of Central-Station Business Getting; Basic Principles of Individual Efficiency; Effective Speaking and Business Letter Writing. In the second year subjects are Hygiene, Health, Recreation, and Elements of Psychology; Basic Principles of Salesmanship; and Policies and Organization of The New York Edison Company.

Of the 24 Edison pupils who were thus graduated with highest honors, 22 are still with the Company, most of these occupying better positions than when they commenced the school work.

Safety First in Electrical Plants.

The Tenney Service Association, consisting of the managers of various public utility companies operated by Charles H. Tenney & Company, Boston, Mass., has appointed a committee to devise plans for minimizing the number of preventable accidents to employees handling this line of work. Palmer York, of this committee, would be pleased to hear from any other companies interested in the work and will be glad to exchange ideas and suggestions for mutual benefit.

Puget Sound Rates Reduced.

The Puget Sound Traction, Light & Power Company and subsidiary companies have announced new schedules of rates applicable to Seattle, Tacoma, Everett, Marysville and King. The reduced rates have been approved by the Public Service Commission of Washington. One of the most important of the new rates is a charge of $2.00 per horsepower per month for current used for irrigating purposes during the summer months. As one horsepower will pump enough water to irrigate an acre, berry growers and others will be able to irrigate at the rate of $2.00 per acre monthly. There is an additional discount on contracts for five months. There is a 20-per-cent reduction in rates for lighting in Pierce and King Counties.

Electric-Vehicle Advertising in Springfield, Mass.

The United Electric Light Company, Springfield, Mass., is conducting a campaign of advertising electric vehicles. It urges the adoption by merchants of electric trucks for city and suburban delivery of goods, and points out that five-ton trucks can run 50 miles on a charge; that they do not freeze in the winter; and that it does not require a chauffeur-machinist to operate this type of vehicle. The wear on tires is also less than with gasoline machines.

The United Company has a fleet of 13 electrics, ranging from 1,000-pound cars to five-ton trucks. They have given entire satisfaction, and the company gives them unqualified endorsement.

Decoration Plans Wanted.

The State Convention of Eagles is to be held in Olathe, Kans., a town of about 3,500 population, next May and it is intended to prepare some electrical decorations for the event. S. M. Brockway, secretary of the Olathe Electric Light & Power Company, should like to receive from other central-station men who have done work of this kind and also from manufacturers and supply men suggestions for carrying out an appropriate scheme of decorations where the available resources are not unlimited.

The city attorney of Bristow, Okla., recently unearthed the ordinance granting a franchise to the local telephone company, which had been mislaid for several years, and found among other things that the ordinance provided for paying two per cent of the gross receipts to the city, a provision which has never been carried out. No record has been kept of the receipts, so that it probably will be impossible for the city to get an accounting.

Electric Sign Data

Some Aspects of Electrical Advertising.

With a view to stimulating interest in questions of vital importance concerning the development and regulation of electric advertising the N. E. L. A. has made the following pertinent suggestions:

The responsibility of the central station for esthetic results, the satisfaction of the advertiser and the increase in display lighting are incontrovertible. Any lack of interest, or unwillingness to assume a proper part of this burden, permits unregulated development and invites restrictions which react and retard legitimate growth.

The installation of unsightly displays or poor mechanical effects creates unfavorable comment and criticism, which eventually leads to unreasonable restrictions.

Care and intelligent judgment should be exercised in the selection and recommendation of displays to the advertisers. The most pertinent satisfactory type, design, size, color combination, flasher, effects, etc., should be selected and advocated. In this manner a result mutually beneficial to advertiser, company and city will be accomplished. At the same time the industry will be protected against unreasonable sign ordinances. All installations should be made with a view to anticipating future municipal requirements by furnishing displays of a high standard, good appearance and proper illuminations, thus offsetting unfavorable developments.

One of the most important features of electrical advertising is the value of motion. The increased efficiency and attractiveness of animated designs greatly exceed the difficulty and expense of caring for the necessary mechanical equipment.

No other form of outdoor advertising is at present so free from criticism and antagonism from esthetic reform organizations as electric advertising. On civic grounds electric advertising is generally recognized as highly desirable. It is the one advertising medium which at the same time serves a distinct commercial service and renders a distinct public service in lighting the thoroughfare. The merchant and manufacture—in fact all who offer commodities or service through this form of advertising—may erect displays indicating their presence, title, wares and functions and while deriving profit therefrom perform an act of appreciated public value.

All electric signs in so far as possible should be beautiful both day and night. Too frequently the daylight aspects are overlooked. As the average use of a display is 18 hours per day, two thirds of which is daylight and one-third artificial light, it is essential that a proper design and combination of pleasing colors be adopted.

Electric advertising in original creations embodying novel mechanical motion effects is the only medium of publicity which is read and reread without tiring the reader.

The central station derives a direct benefit, second only to that of the advertiser, in electrical advertising. In order to further this development central stations should be pioneers in this respect, showing proper evidence of their own faith in its merits by installing a display or displays of sufficient proportions and novelty to establish the highest standard in the community. It is not consistent to solicit actively this class of business while the principal electrical interest of the city is lacking in evidence of its own confidence.

Sign constructed and erected for the Maryland Club Coffee Company, of Baltimore, Md., by the Federal Sign System (Electric), Chicago, Ill.

The sign is approximately 14 feet wide by 25 feet high. There are a total of 400 five-watt lamps used.

The flasher effect simply comprises the lighting of the letters reading "Maryland Club Coffee" and then after a brief interval the coffee pot and cup. The stream of coffee and the vapor are studded with lamps.

No color effects are used.

The reading matter is composed of standard Federal letters, 16 inches high.

Price, complete, will be given on request.

Electrical Construction

Wiring Fixtures.

The careless, hasty workman seldom makes a success at wiring fixtures, especially so if the arm contains a right-angle turn. Usually the fault lies in the fact that proper preparations are not made to do the work. If the arm contains a right-angle turn the fixture wires will seldom pass through by being simply pushed through the tube. In almost every case it is advisable to first pass through a single wire to which the fixture wires may be attached. The method employed to make the single wire pass may be according to any good plan. Some of the best recommended plans are to tie a single ball from a pull socket on a string or thread, which may then be blown or pushed through the tube; another plan is to make a hook on one end of each of two pieces of fine wire, say 20 gauge wire; then by pushing in the two pieces from opposite ends they may be hooked together and the single wire drawn through. When using this plan, care should be taken to draw the wire through in the direction of the shortest run, past the right-angle turn. If the first single wire used is of very light gauge, another heavier-gauge wire may be attached and drawn through before attaching the fixture wires.

It is a mistake to remove the insulation from the fixture wires, so that the insulated ends lay close together. A much better method than this, is to remove the insulation from one, say for a distance of one or two inches more than the other, thereby avoiding compelling both ends to pass the same point at the same time; then too, the insulation should be removed with a sharp knife and the cut made cone shaped. This method makes it more certain that the insulation will not bunch up, should it happen to strike a slight obstruction in the fixture.

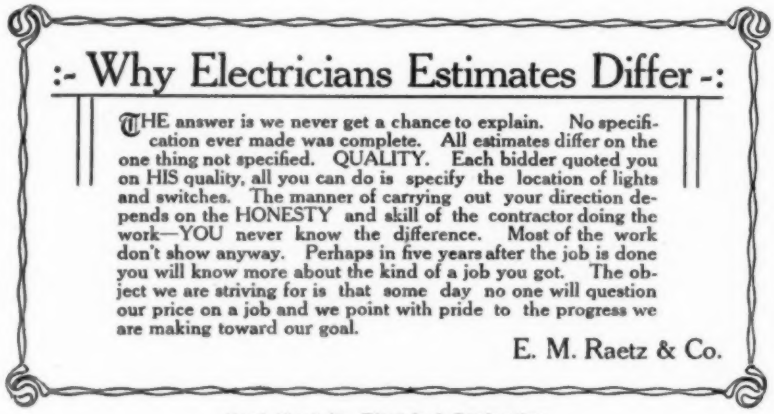
When drawing in the fixture wires, if any trouble is experienced because the fixture wires do not pass readily through the tube, it will be found to be of advantage to apply a lubricant to the inside of the tube, then fasten the end of the drawing-in wire in a vise, or wind its end around a nail and draw up tight with one hand and gently push the fixture wire through the tube in the desired direction with the other hand.

William A. Murray.

Boosting for Quality.

At the recent meeting of the Wisconsin Electrical Contractors' Association, one of the topics of discussion was the apparent unwillingness of the electrical contractor to boost quality material. There was so much competition and so important did it seem to be that a low price should be made on every job that came through, that the contractor dare not specify good material for fear of losing the job.

This is entirely different from the standpoint of at least one contractor. E. M. Raetz and Company, proprietors of the Electric Shop at 16 West College Street, Rochester, Minn., strike out for quality and keep on striking out for it even if they do not get home with the message until the second and third times after a job has gone to a low man. A reasonable amount of persistence in this direction has convinced this company that an unrelenting effort will convince any customer that the best kind of work, using the highest quality of material, is the cheapest in the end.


:- Why Electricians Estimates Differ -:
THE answer is we never get a chance to explain. No specification ever made was complete. All estimates differ on the one thing not specified. QUALITY. Each bidder quoted you on HIS quality, all you can do is specify the location of lights and switches. The manner of carrying out your direction depends on the HONESTY and skill of the contractor doing the work—YOU never know the difference. Most of the work don't show anyway. Perhaps in five years after the job is done you will know more about the kind of a job you got. The object we are striving for is that some day no one will question our price on a job and we point with pride to the progress we are making toward our goal.
E. M. Raetz & Co.

Card Used by Electrical Contractor.

One of the ways that E. M. Raetz and Company talk quality is by submitting a copy of a message recently distributed by the firm of Jones & Kroeger, printers, of Winona, Minn., with each bid. The message in its identical form is reproduced herewith.

A proper use of such assistance as this, backed up by a few successful issues, will do much to help the far-sighted and quality-boosting contractor out of the difficult position that some of his weaker brothers place him in.

Quick Connections for Meter Testing.

In the testing of customers, 5, 10 and 15-ampere, 110 and 220-volt meters with a standard rotating portable test meter and testing rheostate, I find that much time can be saved in making connections with the proper use of a few standard wiring devices.

For connection for the potential coil of the test meter I use two test clamps soldered to the portable cord. These clamp on the blades of the entrance switch, and are safe and efficient. For connection for the load current I use a piece of No. 10 portable lamp cord. For connecting to the wiring in the meter cabinet, I have attached a small separable attachment plug, using only one contact of the plug, to each wire of the portable cord. Then by taking the fuses from the cutout of a circuit and inserting the attachment plugs in their place (taking care that the wired contact in the cap is in contact with the line side in the plug) a very quick and efficient connection can be made. Both the connection for the potential and load wires can thus be made in a moment's time and without disturbing any of the wiring in the meter cabinet.

E. M. Lothrop.

Removing Static Charge From a Belt.

Recently I had trouble with a belt of a high-speed motor, the large amount of static produced by the fast-moving belt appearing to draw the belt close

to the end plate of the motor, so that every time the joint in the belt came around it struck the oil well of the bearing. The pulley was approximately of the same size as the bearing housing. To overcome this I cut a piece of copper strip with teeth on the edge and soldered it in a slot cut in the end of a piece of No. 6 copper wire. I mounted this in front of the belt and connected it to ground. This remedied the trouble. The motor itself was not grounded.

William T. Estlick.

Midwinter Convention of Minnesota Contractors.

The Minnesota Electrical Contractors' Association held a mid-winter meeting at Duluth on January 19.

The meeting was called to order at 10:30 a. m. by President A. W. Zahm, of the Minneapolis Electrical Equipment Company. President Zahm made an address in which he emphasized the desirability of better work and improved conditions, and laid particular emphasis upon harmonious working together to bring about closer relations between present and future members. This was followed by a general discussion, G. M. Jones and R. H. Eddy summarizing the discussion along the same lines at the national convention at Chattanooga.

After the reports of committees and officers, there was a discussion in regard to the bookkeeping system of the National Electrical Contractors' Association. The secretary was directed to obtain a complete set, which is to be sent to each member for examination and study for two weeks or longer. Each member is expected to go over this system thoroughly and see if it is possible to better his own system of accounting. It was also suggested that members call on other contractors who are not members of the association, explaining the system to them and pointing out its advantages.

An address was made by A. W. Lindgren on the Society for Electrical Development, in which he urged all contractors to join. This was followed by a discussion as to the benefits which might be derived by contractors through such membership.

A discussion on attendance resulted in members being urged to attend meetings of both the state and national associations. Such attendance fully repays members through the new ideas and enthusiasm which is injected into their business and personal relations.

A Jovian dinner was served at the Elks Club and was a very enjoyable affair. Following this a photograph of the group shown in the accompanying illustration was taken.

The afternoon session was called to order at 2 p. m. St. Paul was selected as the place for the next meeting, which will be held June 15, 1914. The president appointed the following members upon the Publicity Committee: W. H. Vilett, Minneapolis, chairman; R. H. Eddy, St. Paul; A. W. Lindgren, Duluth.

In the evening a banquet was tendered the visiting members by the Duluth members. This was followed by a theater party.

The members attending the meeting, as shown in the group photograph, are as follows: Standing, from left to right; G. G. Ryder, Minneapolis; R. H. Eddy, St. Paul; G. M. Jones, Minneapolis; O. H. Bakke, Minneapolis; W. H. Villett, Minneapolis; J. M. Hannaford, Jr., St. Paul; George V. Burgess, Duluth; W. J. Chapman, Minneapolis. Front row, sitting, left to right: J. W. Day, Duluth; H. J. Auren; A. W. Zahm, Minneapolis; M. J. Lavalle, Minneapolis; William Burgess, Duluth.

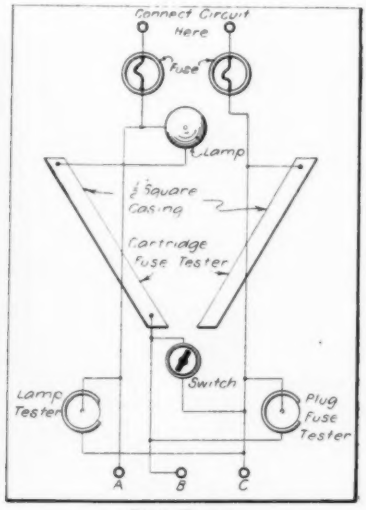
Minnesota Contractors at Duluth.

Baltimore Contractors Elect Officers.

The monthly meeting of the Electrical Contractors' Association of Baltimore, Md., was held on the evening of January 13 at the Hotel Junker. The following officers were elected: President, John S. Dobler; vice-president, William S. Samuel; secretary, William D. Young; members of Executive Board, William D. Young, Charles B. Mills and William Hernstein.

A Convenient Test Board.

The accompanying illustration shows a test board which I made for use in our fixture room and which I find almost indispensable. This can be easily made in spare time at very little expense. The base may be of marble or hardwood, and almost any kind of receptacle will do for the fuses and lamps. For testing lamps and plug fuses I cut out one side of the threads in the receptacles, so that a lamp or fuse can be quickly inserted without having to screw it in. For testing cartridge fuses, I used two pieces of one-half-inch square casing arranged upon a slant, so as to take any size of fuse. The lamp at the top of the board is used to light the work bench when not testing by throwing in the snap switch, shown near the bottom. The whole board is protected by plug fuses in receptacles at the top of the board. The terminals at the bottom of the board marked *A*, *B* and *C* have long cords connected to them. These are used to test fixtures, etc., either in series with the lamp on the board or independently of it.



Test Board.

Allan A. Cunningham, Jr.

National Code Changes.

The Underwriters' Association of the Middle Department, 316 Walnut Street,

Philadelphia, Pa., has published a "Guide to Changes in National Electrical Code, 1913," which it is supplying for ten cents. This is a pocket edition in paper cover and includes in proper order all changes, amendments and new rules appearing in the 1913 edition of the National Electrical Code. Changes in rules governing fittings, materials and details of construction are run in index form only. The latter refers to Class D.

Among the Contractors.

The United Electric Construction Company, Philadelphia, Pa., has been awarded the contract for the entire electrical equipment for the addition to the Ritz-Carlton Hotel in that city. The contract includes engines as well as generators, switchboard, motors and wiring.

The Kingsbury-Samuel Electric Company, Baltimore, Md., has the contract for the wiring of a new five-story concrete building for Philipsborn's store. Galvanized conduit will be used throughout.

The Snyder Engineering Company has been organized in Pittsburgh, Pa., to do an electrical contracting business. The incorporators are G. E. Snyder, X. Snyder and R. B. Snyder.

The Blumenthal-Kahn Electric Company, of Baltimore, has been awarded a contract for the electrical installation in the erecting shop of the Western Maryland Railroad Company, at Hagerstown, Md. This installation includes 22 flaming arc lamps.

The St. Joseph Electrical Company of St. Joseph, Mo., is installing the complete electrical equipment in the fine new Emporia High School at Emporia, Kans. The installation is a very high-class one throughout and includes all wiring, hanging of fixtures, intercommunicating telephone system, and electric clock, besides the installing of all electrical apparatus in connection with the machinery for manual-training work. The building is expected to be completed about February 15.

The Sanborn Electric Company, Indianapolis, Ind., announces its removal to a new store and office building at 309-311 North Illinois Street. The new telephone number is 1550. There are also two Bell telephone trunks—Main 1017 and Main 1018.

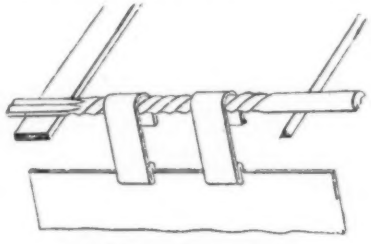
The contract for installing the electrict-light wiring, telephones and other equipment in the new President Street Railroad station of the Pennsylvania Railroad Company in Baltimore, Md., has been awarded to the National Electric Company. This company arranged the illumination of Baltimore's first Community Christmas Tree, which included 3,500 lamps on the tree, five spot lights at the base and a searchlight of 8,000 candlepower operated from a neighboring building. The plans for the illumination were laid out by George E. A. Fairley, assistant engineer for the Electrical Commission of Baltimore.

The Oklahoma Electrical Supply Company, Oklahoma City, Okla., is installing motors and lighting equipment for the Schram Glass Manufacturing Company at Sapulpa. The motors aggregate about 125 horsepower and are on a three-phase 60-cycle circuit. The wiring is in conduit throughout. This company has just completed also the entire installation of electrical work at the new refinery of the Waters-Pierce Oil Company at Sand Springs. This includes a generating plant with two 100-kilowatt Curtis turbines, and about 30 motors aggregating about 300 horsepower. This also was a conduit job. The wiring for the new Washington County courthouse at Bartlesville and the Masonic Home Dormitory at Darlington, which is being done by this company, is nearing completion.

B. R. Blair & Company, electrical contractors of Fort Worth, Tex., have recently completed the wiring, including a 90-drop annunciator system, for the new Chandler Hotel at North Fort Worth.

Busbar For Plating Vats.

A simple but, it is claimed, very valuable modification in the form of busbars for plating vats is illustrated in the accompanying sketch. Instead of a round rod or tube, a rod of angular cross-section is employed, and this is twisted so as to present a series of sharp edges to the suspending and contact hooks of the anode or work. It is claimed that such a rod is easier to clean and provides better contact. These claims are justified in practice. Certainly the condition of the circular busbars on many plating vats is appalling.—*Electricity.*



Busbar for Plating Vats.

LETTER TO THE EDITOR.

The Jobber-Contractor Relation.

To the Editor:

A great deal is written and said about the relation between the contractor and the jobber with respect to their encroaching upon each other's field of activity. From my point of view as a contractor it is unfair to the contractor, especially the smaller (not the curbstoner) ones, for the jobber to maintain a contracting business under another name and thus have an advantage over the legitimate contractor. He pays the regular price for his material. When this is the case it is not to be wondered at that the contractor will buy where he can get the best prices. He is forced to do this in self-preservation. The larger contractor is situated differently. He can buy in large enough quantities so as to go direct to the manufacturer.

We do not see the wholesale grocer going out and trying to get business away from his customer, the retail grocer. It seems that the only salvation the smaller contractor has is to ally himself with the "outlaw" jobber, or try and get in with some jobber as the contracting department of the establishment, thus getting the advantage of wholesale prices.

All this is demoralizing and is working in the wrong direction, and is not in accord with constructive policies.

We have been through this proposition and believe that the remedy is in the hands of the jobbers. If any of the fraternity are found to be carrying on a blind contracting business and this fact were made known and proven among the contractors, it would not be long before the outside business of this jobber would dwindle down to where he would take notice. Competition in the jobbing field has much influence on prices. This territory, for instance, is covered by state jobbers very thoroughly and Chicago jobbers also have their men out and are trying to make it pay. These men are expected to send in an order once in awhile, and whenever a good-sized job comes up the price of the material will be cut to the limit. The jobbers would do better if they confined themselves to some specialty instead of adhering to the present practice. The situation certainly needs a different system of handling if the jobber and contractor are each to make a living out of his business.

E. M. Raetz.
The Electric Shop.
Rochester, Minn., January 17, 1914.

Exports of copper for the week ending January 22 totaled 8,822 tons; since January 1, 25,217 tons; same period last year 17,967 tons.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Keeping Concrete Out of Outlet Boxes.

In placing conduit and outlet boxes in concrete construction it is well before the concrete is poured to drill a small hole in the planking underneath and set the box directly over this. This will keep the box from being filled with fine cement, as the water and fine solid matter carried with it can run out at the bottom. The box is thus left empty.

Roy Ellerthorpe.

Handling Tape.

I have often had trouble in taping big joints where I held the whole roll of tape in my hand, as the edges often catch on the next turn of the roll and the tape becomes torn. I have found that this can be prevented by taking a pocket knife and drawing it across the flat side of the roll, so as to cut a thread or two at the edge of the tape. I scratch the roll in this way on both sides from center to edge in four or five places. This prevents the thread from catching and tearing off the tape, and it also makes it easier to tear off a small piece of tape.

Gordon Allen.

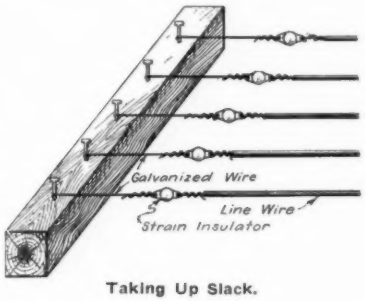
Hanging Short-Stem Fixtures.

When hanging fixtures having stems so short that the canopy can not be lowered so as to conveniently make the splices to the supply wires, proceed as follows. Cut the fixture wires to the desired length and attach them to the supply wires; finish making the necessary connections, complete, soldering the joints, and cover with tape. Then screw the fixture tube in the hickory; fish the fixture wires through the tube and make the connection to the socket last. Of course, the canopy should be pushed on the tube before connecting the socket.

William A. Murray.

Taking Up Slack.

A scheme I have often used to pull up slack in large feeders which are run open, as is often the case in mill construction, is as follows. Instead of the usual turnbuckle, simply take five-eighths or three-quarter inch screws and drill a small hole, as shown in the accompanying figure. After screwing the lag screw into the timber almost up to the hole, push the heavy galvanized wire into the hole, but not through, and wind up the wire until your line is tight. Of course if the line has much sag, this must first be taken out by means of a block and tackle, the same as you would for turnbuckles. If the line sags at any time



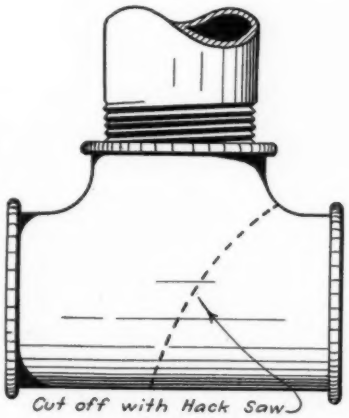
Taking Up Slack.

you can always take it up by simply giving the screw another turn or so. No matter how great a pull is on the lag bolt it will never unscrew. The pulling strain is always next to the timber, due to the wire sinking into the wood as it is screwed in.

B. H. Fisher.

An Improved Bending Tee.

Many devices have been proposed for bending conduit, but to the practical man few of these are as handy as the one-inch tee. The accompanying figure shows an improvement on the ordinary tee. It consists in cutting off



Bending Tee.

a beaded tee along the dotted line shown. This will make it easier to handle the pipe and bending is possible at new angles. If the tee is beaded it will not be likely to break in use.

Ben R. Browne.

Hoisting Pipe in Loft Buildings.

It is sometimes necessary for electricians to hoist their own pipe in new buildings, using a block and tackle. This is dangerous when not done properly. We hoist the pipe up in bundles, putting a sack over the end of the bundle. This is tied with an ordinary knot around the sack and then a half-hitch or two is taken around the other end of the bundle. The half-hitch tightens as the bundle is pulled up and the sack over the bottom end prevents any single pipe from slipping out. It is always safest to have the coupling ends of the pipe upwards.

On two-inch and 2.5-inch pipe we use a double hook made out of pencil rod and hoist up two lengths at a time by hooking one pipe to each side of the double hook. One half-hitch around both pipes near the top is all that is necessary. With three-inch pipe and larger sizes we hoist one length at a time.

A method we use for making up large pipes for risers is to cut a hole in a cap fitting the pipe and fasten an eye-bolt through this cap by putting a nut on the inside. The hole in the cap is made a little larger than the shank of the eye-bolt. Then the cap is screwed on, a rope tied through the eye-bolt and pulled up. While one man holds the pipe in position, another makes it fast. Henry Fleishman.

Handling Fixtures in the Shop.

We find a very convenient way to handle shower fixtures while building them up is to suspend an ordinary awning pulley from the ceiling, pass any suitable heavy cord or rope over this and on one end put a hook bent out of heavy wire. The other end we fasten to an awning cleat located at a convenient and accessible place near the bench, and the crowfoot is hooked to the hook and the fixture drawn up to a convenient height to work on. This is handy for wiring and assembling any fixture and beats climbing up a ladder to hang it to a rigid fastening. We have several such rigs in our shop. We use them mostly for showers, for which they work the best. This is also better than handling on a bench and saves scratching. Where we have small fixtures to handle we have a piece of old carpet on the bench, which saves marring the finish.

We keep all our small parts in cigar boxes, which are readily obtainable, and they permit of a very handy arrangement of parts on the shelf.

We keep standard nipples on hand, cut and threaded; it does not pay to cut nipples as needed and soil the hands and have to wash up when you come to handle casing and light-colored cord. E. M. Raetz.

Among the Supply Men

Effective and Attractive Window Displays.

One of the most interesting, instructive and elaborate window displays ever exhibited in the City of Seattle is herewith reproduced. The picture shows two trains, a freight and a passenger, electrically propelled, climbing the mountain grades which are encountered between the cities of Puget Sound and the summit of the Cascade range on the line of the Chicago, Milwaukee & St. Paul Railway.

This miniature railway was designed and built by Burton L. Stare, of the Northwestern Electric Supply Company and is on exhibition at the uptown offices of the company in the Prefontaine Building, Yesler-Way.

There are 265 feet of two and one-eighth inch gauge, rock-ballasted track, nine electrically operated semaphores and six automatic switches. The elevation is nine feet and the line has a grade of one inch to the foot on straight track and three-fourths inch on the curves.

Sixty gallons of water tumbling over the three waterfalls provides the power for operating the two trains, including the electrically operated semaphores and switches.

The passenger train is 11.5 feet long and the freight 13 feet. Both derive their motive power from a third rail. The motors on the trains draw the energy from this rail under the cars just as the trolleys of the city obtain their power from the overhead wire. The passenger train is equipped with 15 motors and the freight carries 14.

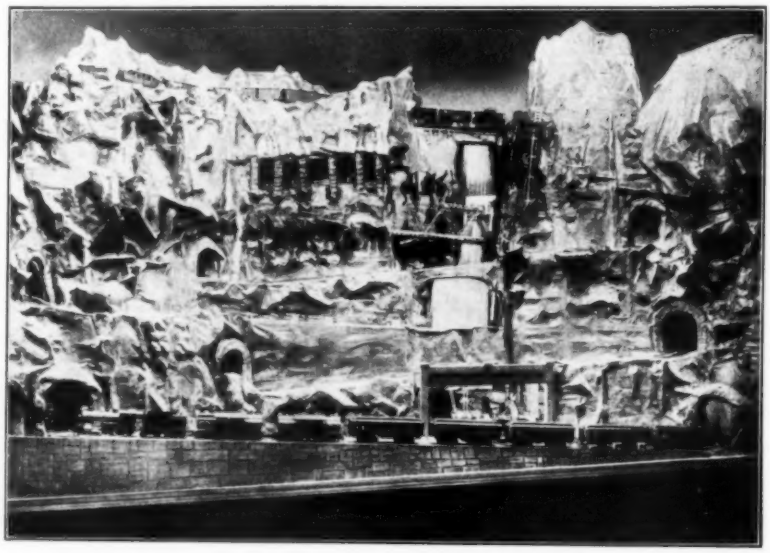
Contractors which operate the block signals and control the section of the track near it are placed at intervals along the line. As the trains go up the grades the contactors cut in a higher voltage to enable the train to negotiate the grade or to make a hard curve. More power is required on curves than on the straightaway. The potential ranges from 14 to 22 volts. Coming down the side of the mountain the reverse operation is performed, and decreasing the voltage acts as a brake holding the train in check.

As soon as one of the trains reaches a certain point, a section of the track will be killed and the semaphore set at danger. The train will be forced to stay at this point until the solenoid, back of the tunnel, closes the circuit on that section of track, releases the semaphore and sends the train on its way. There is absolutely no chance of collisions as the two trains can not get in on the same section of track.

The switches are operated electrically by means of contactors. When the passenger train arrives at a certain point the switches along the line are set. When it arrives at another station on the line it kills a section of the track and at the same time energizes the track in the loop at the top of the mountain where the freight is waiting. When the freight train makes the descent it uses another set of contactors, closes the switches it has used and opens the passenger loop switches so that the freight can not get in on the passenger track.

From the diminutive replica of a water-turbine power house at the foot of the mountain to the electrically operated semaphores and the tail lights on the miniature "Olympian" it is a complete electrically operated railroad on a small scale.

Through the passes of the Cascade Mountains the little trains glide, here emerging from a tunnel to wind about the face of a precipitous cliff; disappearing into the heart of the papier-mache mountain to reappear on the little steel bridge away up the gorge. With headlight flashing, yellow cars glistening, drivers grinding, the train is halted by the warning arm of the semaphore; the restraining arm of the signal tower drops, the block is clear and the train slowly, then faster, moves across the bridge and its tail light whisks from view into one of the many tunnels. Mr. Stare, designer and builder of the exhibit, states that he thinks it highly probable that the railroads of the future will be run without engineers, and that they will be started and stopped and controlled from the train despatchers office.



Window Display of Northwestern Electric Supply Company.

Illinois Electric Company Holds Big Sales Conference.

The Illinois Electric Company, Chicago, held a very interesting sales conference the week ending January 10. Addresses were made by a number of manufacturers' representatives during the week. The entire meeting was marked by close attention to the papers and discussions, and everyone present was well satisfied. The conference wound up on Saturday afternoon with a more or less open meeting at which addresses were made by

H. B. Kirkland, of the American Conduit Manufacturing Company, F. F. Skeel, of the Crouse-Hinds Company, and A. A. Gray, Chicago.

During the week T. P. Gaylord and William R. Pinckard, of the Westinghouse Electric & Manufacturing Company, took a prominent part before the conference, explaining the details of Westinghouse apparatus in connection with the new arrangements the Illinois Electric Company has made as sales agent for Westinghouse specialties. Among the salesmen of the Illinois Electric Company attending the conference were J. A. Duncan, Des Moines, Iowa; H. H. Morehouse, Ottumwa, Iowa; J. A. Sines, Los Angeles, Cal.; Cameron MacIntyre, Lincoln, Neb.; A. W. Dunham, Fond du Lac, Wis.; W. H. Pearl, Indianapolis, Ind.; F. H. Shumaker, Goshen, Ind.; F. P. Kennedy, Madison, Wis.; F. R. Pope, St. Louis, Mo.; Stuart Walters, Peoria, Ill.; Clyde B. Hightshoe, Des Moines, Iowa; D. C. Penniman, Minneapolis, Minn.; William T. Cowap, Oshkosh, Wis.; D. Newman, Chicago; William C. Booth, Chicago.

Washington Meeting of Electrical Supply Jobbers Association.

The next meeting of the Electrical Supply Jobbers Association will be held at Washington, D. C., at the New Willard Hotel on February 17, 18 and 19. Special cars for the meeting will leave Chicago *via* the Pennsylvania Railroad, Union Station, Canal and Adams Streets, on Monday, February 16, at 10:30 a. m.

The Esco Electric Supply Company, Albany, N. Y., reports an increase of 40 per cent for the last six months of 1913 over a similar period of 1912. For the first six months of the year the volume showed an increase of nine per cent. The company makes a practice of closing its place of business at 3:00 p. m. every Saturday and devoting the remainder of the afternoon to a sales conference, cleaning up stock and getting ready for a new start on Monday.

The Robertson-Cataract Electric Company, Buffalo, N. Y., held its sales convention from January 7 to 10, concluding with its annual "Ginger" dinner, at which 75 employees and guests were present. Among the guests at the dinner who had addressed the sales convention were A. D. Babson, General Electric Company; W. Hessel, Detroit Fuse & Manufacturing Company; F. X. Cleary, George Cutter Company; Thompson Cummings, Hubbard & Company; J. M. Smith, Holophane Works of General Electric Company.

Public Service Commissions

MASSACHUSETTS.

The Public Service Commission has approved the giving of free transportation by the Boston and Worcester Street Railway Company to district nurses of Wellesley.

The Commission, in its annual report, issued January 21, recommends a complete separation of the Boston and Maine from the New York, New Haven and Hartford Railroad Company, calls for the relinquishment by the New Haven of steamship lines under its control which have their terminus in Boston, and reiterates the views expressed in previous reports of the Railroad Commission that electric railway lines better serve the public when under independent management than under control of railroad interests.

NEW HAMPSHIRE.

The Public Service Commission has granted the petition of the Massachusetts Northeastern Street Railway Company for authority to issue $710,000 of capital stock.

The Commission has ordered the Maine Central Railroad Company to install electrically operated automatic crossing signals at Twin Mountain, Scott's, George's, Columbia Bridge and Crossing 141.2, north of the latter.

NEW YORK.

The Public Service Commission for the First District submitted its annual report for the year 1913 to the Legislature on January 19. The report was in manuscript form but will be printed later for distribution. It is largely taken up with the activities of the Commission in respect to rapid transit in New York City. There are 98 operating and lessor companies in actual operation under its jurisdiction. Of these, 68 are transportation companies, and 30, gas and electric companies.

NORTH CAROLINA.

The North Carolina State Corporation Commission has begun active effort to bring all electric light, gas, water and power companies under direct supervision of the State. To this end the Commission has issued a call to all such companies other than municipal corporations to file with the Commission within thirty days complete schedules of their rates and charges for each class of service, together with any schedules of discounts for quality of service or prompt payment. The Commission gives notice that all these companies will be called upon at the close of each calendar year to report covering their operations, and showing capital stock, dividends, etc.

OHIO.

The Public Utilities Commission has declined to give its approval to the issue by the Maloning County Light Company of capital stock to the value of $10,000 to be used to defray the expenses of a preliminary investigation of a project for an electric power plant, on the ground that the applicant has no visible or tangible assets and that its further contemplated plans of capitalization and operation have not been submitted.

OKLAHOMA.

The Oklahoma Corporation Commission has required an increase from $15,000 to $17,000 in the supersedeas bond given by the Pioneer Telephone Company to cover any possible excess charges in Oklahoma City pending the Commission's final action on the petition for approval of the rates which are now being charged. The company made a bond of $15,000 in January, 1913, but according to the most recent figures in the hands of the Commission this is not sufficient to cover the excess. This bond is entirely aside from the question of a refund for the period from June 1, 1909, to December 31, 1912, ordered by the Commission, and in which its action was affirmed recently by the state Supreme Court.

SOME FACTS RELATING TO DEPRECIATION AND RATE MAKING[1].

By Halford Erickson[2].

The subject of depreciation is one which has gained a great deal of prominence, especially since the introduction of government regulation of public utilities. In existing discussions upon it, however, most of the emphasis has been laid upon how depreciation is to be determined, and upon the necessity of providing for it. Concerning the methods of recording depreciation upon the books and records of the plant, or in other words, on the accountancy of depreciation, less has been said. It is of course true that the proceedings of technical societies, and other journals of this character, have dealt more or less exhaustively with this subject. On the other hand it is also a fact that in most standard books on accounting the subject is passed over without giving most of the facts that are desired by those who are looking for detailed information in the matter.

By depreciation is usually meant the gradual lowering of value of the property and equipment used for industrial and other purposes. In a broad sense it can perhaps be grouped and explained under the following four headings:

(1) Wear and tear, or minor renewals which are ordinarily made up of repairing or replacing minor equipment, as well as of the smaller parts of the larger units of the equipment as they wear out, or become useless otherwise. These are to be considered a part of the operating expenses under the various maintenance accounts.

(2) General decay, or that part of wear and tear which cannot be made good through the ordinary repair included above under (1). General decay also includes what is sometimes described as decrepitude or decline in value due to age and the action of the elements.

(3) Obsolescence, or the lowering of the value of property due to progress in the art or to the development of something newer, rendering the old equipment uneconomical, or public requirements by legislation, ordinances, etc.

(4) Inadequacy, or a reduction in value, resulting from unexpected developments and growth in business and demands for enlarged service coming from the public.

According to the definition of depreciation which characterizes it as a lessening in values, depreciation includes maintenance or upkeep as well as that lessening of value which is usually termed depreciation. In most systems of accounting, however, these two classes of outlays are kept apart. Upkeep or minor repairs are charged directly into the maintenance accounts, while such replacing of the larger parts as must be made from time to time are charged to depreciation. What is thus termed depreciation is as much of an operating expense as ordinary maintenance. Investors justly insist that such depreciation shall be made good in the charges that are made for the services rendered. If it was not made good in some such way as this their investment would sooner or later be an almost total loss. Without proper provision for depreciation the plants would also in comparatively short time be unable to render efficient service.

When charges or rates are high enough to cover such depreciation then it also follows as a matter of justice that the amounts so earned for depreciation should be set aside for the purposes for which they were collected, and not withdrawn from the plant or the business in the form of dividends or for any other purpose.

There are many reasons why it is exceedingly important that the amounts thus collected for depreciation should be kept on hand until needed, and then devoted to proper purposes. Unless they are so set aside there cannot always be any real assurance that the service will be kept up to an adequate standard. Without some such reserve to draw on, it is difficult for plants whose credit is strained, to secure the money with which to meet the cost of such extensive renewals as are frequently necessary in the public-utility business.

The chances also are that when the amounts so earned for depreciation have not been properly set aside, both for rate making and for other purposes, the present value, or the cost new less depreciation rather than the original cost or the cost new will be used as the basis for the valuation of the plant. At any rate there is a marked tendency in this direction on the part of appraisers almost everywhere. They appear to regard depreciation earned and improperly withdrawn in about the same light as the withdrawal of capital from the business. For many plants such omission of depreciation from the value upon which rates are based is likely to result in rates that are considerably lower than would otherwise be the case. The losses to the plant through the lower rates may then in the long run be even greater than its temporary gains from withdrawing the depreciation allowance from the business.

The omission of the depreciation charges from the operating expenses results, of course, in a higher net earning than is the case when the depreciation allowances are included therein. The omission to properly charge expenses with depreciation creates in fact false net earnings and this false net earning in turn often leads to higher than reasonable valuation of the plants for taxation and other similar purposes. In appraising property for taxation the assessors aim to find the market value. This value in often found by capitalizing the net earnings on about a six-per-cent basis. But if the net earnings are too high, because of the fact that depreciation has not been included in the expenses, then it necessarily follows that the assessed valuation will also be too high and that the plants are made to bear higher taxes than should be levied on them.

The amounts thus earned for depreciation would also, if set aside, constitute valuable assets in the business. They would in fact represent a reserve from which money for new extensions could be borrowed and kept until the outlays could be conveniently financed in the regular way. There are also many other purposes for which such reserves might be profitably employed. Thus they might enable the plant to do business on a cash basis and thus enable it to profit by all discounts and other advantages that usually accrue from having ready cash on hand. Many other reasons not only for making adequate allowances for depreciation but for devoting these allowances or reserves to their proper purposes might also be given. Those which have been outlined, however, would seem to be sufficient to show that these matters are important enough for proper consideration.

In examining the books, records and annual reports of many plants one can hardly help noticing that there are many shortcomings in the methods they employ in recording on their books and records the various transactions that are connected with depreciation. Whether this is due to facts that the best practices in such matters have been overlooked or to the fact that the Railroad Commission in its classification of accounts has omitted detailed explanation upon these points is not clear.

Many, for instance, do not seem to clearly distinguish between maintenance and renewal items, nor between renewals and new construction. The result of this is that these accounts are often either over or under stated. The effect of this is not always the best

[1]A paper presented before the convention of the Wisconsin Electrical Association, Milwaukee, Wis., January 16.

[2]Member of the Wisconsin Railroad Commission.

either for the utility company or public.

Many also fail to make proper entries for property discarded and taken out as well as for the new property which takes the place of the property taken out. One effect of this is that the construction accounts of such plants do not show even approximately the original cost of their property. Such omission constitute serious drawbacks in the appraisals of the plants for they deprive the appraisers of some of the most important elements that enter into the valuations.

There also seems to be some confusion as to the respective meanings that are attached to the depreciation reserve account and to the depreciation-reserve-fund account. The depreciation reserve account, as the term is commonly understood, is an account created by withholding a portion of the revenue for the purpose of renewing worn out and discarded equipment or plant. The depreciation-reserve-fund account on the other hand resembles a sinking-fund account. It is created by the transfer of actual cash to the depreciation fund which cash unless temporarily invested is there held until used for renewals. These distinctions between these two accounts are often overlooked and the one is therefore also often used for the purpose of the other.

Shortcomings of the kind described often lead to complications that are out of line with the best practise. It is quite likely, however, that many of these shortcomings can at least in part be traced to the fact that, as stated above, the Commission's classifications do not always go far enough in explaining the methods to be employed. An example in point is that there is therein no detailed description of the various entries that are necessary in order to show the full results of setting aside the depreciation allowance, the taking out of the discarded property, the replacement of it by new property, and the treatment of the scrap value. In this case the classifications show that the allowance for depreciation should be charged to a depreciation account in the operating expenses and credited to the depreciation reserve account, but they do not make such further explanations as may be necessary to the best practice of dealing with depreciation. For instance, they do not show very fully that the discarded property should, for its original cost, be credited to the construction account and charged to the depreciation reserve account; that the new property which takes the place of that discarded should, for its cost, be charged to the construction account, and credited to cash, nor that the scrap value of the discarded property should be charged to the material account and credited to the depreciation reserve. With such omissions in the Commission's classifications it is perhaps not to be wondered at that there should also be shortcomings in the records of many utilities.

Again, our classifications do not show as fully as they should the fact that, when the depreciation reserve is secured by cash and a depreciation-reserve-fund account is created, it is necessary to draw a voucher check for the amount, charging it to the said fund account, and crediting it to cash; that when a depreciation-reserve-fund account has thus been credited the discarded property, when taken out, should, for its cost, be charged to the depreciation reserve, and credited to new construction; that the cost of the new unit, which replaces the one discarded, should, for its entire cost, be charged to the construction account and credited to the depreciation-reserve-fund account for so much of this cost as may agree with the cost of the property replaced, while the amount by which the new property may exceed the cost of that which it replaces should be credited to cash; and that the scrap value of the equipment discarded should be charged to the depreciation-reserve-fund account and credited to the depreciation reserve account.

These are technical matters and should perhaps not be gone into here. They are, however, so closely connected with correct methods of accounting, that I thought best to make some reference to them. In the same connection it may also be said that each of the entries described should be accompanied by such explanation as will give a fairly complete history of the property involved for both sides of the transaction. Such explanations in turn would greatly facilitate such analysis of the construction accounts as may become necessary from time to time.

If the charges due to depreciation are not carried through the construction accounts, that is, if these accounts are not credited with the cost of the property taken out and charged with the cost of the property put in, but simply charged with the amount by which the cost of the new property exceeds the cost of the property discarded, then it becomes necessary in order to obtain some light on the original cost of the plant to analyze not only the construction accounts but the reserve accounts and maybe several other accounts as well.

The classifications of the Commission also fail to draw as distinct a line as is desirable between the maintenance and renewals. The relation between maintenance and renewals is so close that it is almost impossible in all cases to outline in advance just what items should go into the one account and what items should go into the other. This is one of the questions, however, which is being looked into and upon which we hope to be in position to furnish further facts before long. It is quite possible that in the end it will be found that the best way to deal with the matter will be to determine as best one may the total cost of both repairs and renewals and then to set aside into the reserve the entire amount and charge to it as made not only all the repairs but all the renewals as well.

Other shortcomings in the classifications might also be pointed out, but I have perhaps indicated enough of them to show what the situation is and to indicate that the Commission may be partly to blame for the fact that many utilities do not keep all of their accounts in accordance with most approved methods. Some of these omissions in the classifications have already been supplied by supplementary issues. Others will probably be covered in the same way in the near future.

Rates.

From a legal as well as from an economic point of view the rate schedules of public utilities should, under normal conditions, yield revenues enough to cover reasonable allowances for operating expenses including depreciation and interest and profits on the investment. Furthermore, the total cost represented by these amounts should be so distributed that each branch of the service and each class of customers therein are made to bear as nearly as practicable their just share of the entire amount. The cost of the service basis is thus in effect made the legal basis for rates. As normal costs are also the basis for normal prices, the cost of the service becomes the economic basis for such charges.

To correctly determine not only the total cost of the service but the respective proportions thereof, that should be borne by each branch and class of the service are exceedingly important tasks, for such determinations vitally affect not only the distribution of the social income but industrial and social developments. Such determinations are also difficult to make and this for the reason that both the theories and facts upon which they should be based are often complicated and even conflicting. Unless they are made with a fair degree of correctness, however, it is almost certain that some plants will earn more and others less than they should earn; and that some branches of the service and classes of customers will bear more and others less than their just share of the total cost.

While such determinations are difficult to make the complications involved therein can usually be overcome by a careful study and analysis of the facts and conditions involved, and by the application of sound methods to each step in the process.

The operating expenses are often relatively higher for some branches than for other branches. This is also true of the fixed charges. The situation in this respect is largely determined by local conditions. Under normal conditions each branch should bear its own operating expenses together with its full share of the interest charges. When conditions are not normal it may be necessary to so shift the interest charges that some branches bear less and others more than their normal share of the same. Ordinarily no part of the service should be allowed rates that are so low as not to cover the operating expenses plus at least something for the interest on the investment. For business that cannot be had on better basis the term operating expenses may have to be so construed as to mean additional costs that are incurred in taking it on. Mere inequalities in rates are not regarded as unjust until the point is reached where they result in some injustices to some one else. What is thus true in these respects for the different branches of the service is also true for the various classes of customers in each branch.

Attention is especially called to these rules and facts at this time because there are some who hold that while the cost of the service is a fair basis for rates for public utilities the figures to be used as the basis for rates thereunder should be the ones obtained when the total cost for the plant as a whole is divided by the total sales, say in kilowatt-hours and that the average thus obtained should be the rate for all branches of the service and for all classes in each branch; and further because there are many indications to the effect that we are soon likely to again be confronted by an agitation for a uniform meter rate of this sort. While such a basis as this disregards the effect of such factors as the demand on the plant, the hours of daily use of the service and numerous other conditions which vitally affect the cost of the service, it is on the face of it plausible enough to attract considerable support particularly among those who have not had the opportunity to carefully study the matter. In the past this demand for one uniform rate has been strong enough to be carried through. This is especially true for gas and water works. When well supported and directed it is likely to be more effective on public authorities than on the plants themselves. If it fails to carry the day when raised it is usually because the issue has been fairly and openly met on its merits.

Normal costs are ordinarly the basis for normal prices. Where active competition is largely absent costs are about the only basis upon which in the long run prices can be safely determined. While costs with certain limitations is in the public-utility field the most important basis for rates, the question arises whether by costs in this case is meant the cost for each branch of the service and for each class of customers therein as obtained when all the factors that enter into this cost are taken into consideration, or whether it means the average cost for all branches and classes regardless of the conditions. In order to shed some light on which of these two sets of cost is the proper basis for rates in the electrical field, it is necessary to analyze the conditions under which this service is rendered.

The nature of the electric utility is such that its products are more of a service than a commodity. Its products must be used in connection with the plant because they cannot be stored except to a limited extent. As electricity is largely used for lighting, the greatest demand on the plant is in the evening. While this maximum demand may not last long the plant must be large enough to meet it. The demand on the plant also varies with the seasons, being much greater during the winter than during the summer months. The effect of such variation in the demand is that for the greater part of the time as much as 80 per cent of the capacity of most plants remain idle. Public-utility service is also decidedly a service of decreasing costs. This is especially true of such service as can be rendered during such periods of the day when the regular demand or load is at the lower levels. From two-thirds to three-fourths or more of the total expense of the service when fixed charges are included therein are mostly independent of the amount of current or energy generated and are about as great when the output of current is smaller as when it is greater. Hence the greater the amount of current that can be sold during the off-peak hours the better is the load-factor and the lower the cost per unit of current will be. The power user as a rule enables a much better utilization of the plant then is the case for lighting users, and therefore also often oftain better rates. Current for power comes in competition with other forms of power. To a very limited extent this is also the case for current used for lighting.

In view of these and other facts in order they may become proper basis for rates, it is necessary to closely analyze the expenses of a plant and to classify them in accordance with their nature, branches of the service and classes of customers. In studying their nature, it is found that some of these items depend directly on the capacity of the plant and vary with this capacity; that others depend entirely on the customers of the plant and vary with the number of customers; and that there are still other items which depend entirely on the output of energy and vary with variations of the amount of this output. It is further found that there are also many items in the cost of the service which do not depend directly upon either the demand, the customer, or the output, but which are indirectly dependent upon two or more of them. They are in the nature of overhead charges. In addition to this it is also found that some of these expense items are relatively higher for some branches or parts of the service than for others.

In view of these facts it is necessary in order to established rates that are equitable to all, to separate those expenses which depend directly on the demand, the customers, and the output into their respective classes. It is further necessary to properly apportion the indirect or overhead expenses between these classes in such a way that each class is made to bear its proper share thereof. In addition to this it is also necessary to properly apportion these classes of expense between the different branches of the service. Likewise the customers must also be classified by branches of the service while those in each branch may have to be grouped in accordance with their demand on the plant and other characteristics of the service they obtain.

Now, these apportionments are logical and well within reason. If this is the case then it would also seem equally logical and reasonable that each customer or class of customers should bear its or their just proportion of each of the three classes of expenses that were named. That is they should bear demand costs in proportion to their respective demand in kilowatts on the plant; they should bear customers' costs in proportion to the number of customers; they should bear output costs in proportion to the respective amounts of current or energy used.

When the demand costs are thus allotted to the customer on the basis of the proportion of his kilowatt demand; when the consumer costs are assigned to him on the basis of the number of customers; and, when the output costs are apportioned to him on the basis of the kilowatt-hours used, it is of course found that while each customer bears only his just share of the respective

demand, consumer and output costs, the average cost per each kilowatt-hour is much higher for those customers who use their service or installation a short time only each day than for those who use their installation for longer period each day.

A rate schedule under which each customer is made to bear his just proportion, in each case, of the demand. the consumer and the output expense thus results in higher average rates per kilowatt-hour for short than for long-hour users. While this difference in the rate or cost is just, it is often strenuously objected to by those who, as stated above, hold that the average cost per kilowatt-hour that is obtained when the total cost is divided by the total kilowatt-hours sold, should be the rate that is levied uniformly on all customers. Since residences or lighting customers are usually short-hour users, and power customers are often long-hour users it also follows that the average rate paid per kilowatt-hour is higher in the former case. This fact is often held up as an example of unjust discrimination. Even the ordinary demand schedule under which the rate for the first few hours of daily use of the active load is higher than for current used in excess of this is attacked because it is deemed unfair. In support of their position it is constantly alleged that such schedules are not just to small users.

Now, these criticisms of the demand system of charging are either misleading or well taken. If misleading or unjust, then it should be possible to establish this fact. If well taken, then this should also be made clear. While I do not hold a brief either for or against the demand method I desire to add a few additional facts to what I have already said.

It is a difficult matter to understand how any one who has fully analyzed the expenses and the operating conditions generally of public utilities can consistently deny that there are not certain expenses, such as fixed charges and standby cost that depend on the capacity of the plant which in turn is determined by the joint demand upon it by the customers and that if such is the case why these demand costs should not be borne by the consumers in proportions to their demand rather than on any other basis. There surely is a closer relation between these expenses and the demand in question than between these expenses and the kilowatt-hours used. Likewise it is quite clear that certain expenses, such as keeping customers' records, collecting the bills and other items of this nature, depend on the consumer; that they are about as great for small as for large customers; that they are much more closely related to the customers than to the kilowatt-hours used or any other unit and that for these reasons they ought to be borne in proportion to the number of customers. When it comes to the output cost, however, it is quite obvious that these depend more closely on the kilowatt-hours used than on any other unit and that they should therefore be distributed on this basis. Such distributions of the expenses as these just outlined furnishes material for the proper kind of cost curves, such curves as are used for scientific and other purposes where accuracy and sound conclusions are required. They also furnish sound basis for equitable rate schedules. At any rate, there are the best of reasons for believing that this is the case.

Those who have closely studied these questions well know that apportionments of the expenses that are required in the classifications outlined can be so made as to be fair to all concerned. There is, in the case of all utilities, a considerable proportion of items which depend directly upon each class of expenses and upon each branch of the service. Such items can be classified directly under that class and under that branch of the service for which they were incurred. There are also a considerable number of expense items which are common to two or more classes and two or more branches of service which can be fairly apportioned either on closely related units or on the direct expenses. To go into details on these points is hardly necessary here, since most of you are no doubt familiar with the methods employed for these purposes. Suffice it to say that the trustworthiness of such apportionments has repeatedly been established.

The cost basis of rate making thus outlined is also elastic enough to be adjusted to the various conditions that arise in this field. Under it consideration can be given to the long-hour user who, in addition, is also an off-peak user; to the long-hour user whose use also extends into the peak hours; to the short-hour but off-peak user; to the short-hour users whose use also comes during the peak hours and to practically all other conditions that may arise. Thus it can also be made to cover such customers who, for competitive or other reasons, can be had only on the so-called additional cost basis of charging.

When it comes to the method of charging, however, which, as stated above, is represented by the average cost per kilowatt-hour sold to all the current sold by a plant, the situation is different. The rate thus obtained will be the same regardless of the conditions. Under it the power user would pay the same rate as the lighting user and the long-hour user in both cases would be charged as much per unit as the short-hour user. If all customers were in the same class, if their demand was the same and also came at the same time, if they used the same amount of current, if there were no competitive or other conditions of this nature to contend against, if, in short, the similarities between them in the situation under which the services were rendered extended to every condition by which the price of the current could be affected then a uniform meter rate which is the same for all customers would no doubt be practicable. But such similarities are seldom if ever encountered. In actual practice it is found that the demand, the quantity of current used, and other conditions vary not only as between the different branches of the service, but as between the different classes of customers in each branch. These differences do not only extend to factors which affect the cost of the plant of furnishing the service but they also cover conditions which measure what the customers can afford to pay for it.

As in most cases, electric power costs less to furnish than electric lighting and as long-hour users are relatively much less costly per kilowatt-hour than short-hour users, and as in addition to these differences there are also many other conditions under which the costs differ as between various users, it must be quite apparent that a uniform rate, such as that just described, must be unjustly discriminatory. No rate schedule under which some are made to contribute more and others less than their just proportion of the revenues of the plant can be fair to all concerned.

Under a rate schedule, the rates in which represent the average cost for the plant and are therefore the same for all branches of the service and for all classes of customers, the cost for power and for long-hour users generally would be so high that the service could not be generally used for industrial and commercial purposes. Manufacturers, for instance, who are producing for the open market cannot afford to use current for power or other purposes unless it can be had at as low cost as power produced by other means. For most plants the average rate is much too high not only for competitive business, but for much of the long-hour service. Being too high, it also follows that they will not bring the business. Loss of business means loss of revenue. It means more than this. Since the cost per unit of producing current decreases with in-

creases in the business, such restriction in the output not only reduces the revenues but it increases the costs per unit. It tends to reduce profits and to increase rates and hence results in losses to the plant and higher rates to its customers. No current should be sold at a loss but the more of it that can be sold at a profit the better for all concerned. These facts are well understood by the wideawake manager but seem to be hidden to a large proportion on the outside.

These illustrations may even be carried further. Business which cannot be had on better terms should be taken even if the revenues it produces only slightly exceed the additional cost the plant is put to by taking it on. The amount by which the receipts are greater than such additional cost may be counted as profits, for it aids in meeting the fixed charges of the plant and by its amount reduces the share that otherwise would have to be borne by the rest of the customers. Under the average cost or rate, however, business of this kind could not be had and such rates would therefore tend to restrict the business of the plant at the expense of all concerned.

The importance of the fullest possible utilization of the power plant can hardly be overestimated. Now, every plant has a peak load which is far above the average load and which peak load the plant must be equipped to meet. The capacity of this equipment determines very largely the fixed charges, that is, the interest, depreciation, taxes and insurance. If the capacity, because of the peak load, has to be out of proportion in size to the average load and the output of the plant therefore comparatively small, then it also follows that the fixed cost per unit of output will be high. If, on the other hand, the average load is high, then the output will be greater, and, as the fixed charges, which do not vary with the output, will then be distributed over a larger number of units of output, the amount per unit will of course be smaller.

This may be further illustrated: Thus, if the investment in a power plant amounts to, say, $100 per kilowatt of capacity, if the fixed charges thereon amount to 14 per cent, or to $14 per kilowatt per year; if, furthermore, the plant is operated the entire year, then the cost per kilowatt of output of current would be 0.16 cent when operated full capacity, about 0.32 cent when one-half the capacity was utilized and about 0.64 cent on a 25 per cent load-factor.

Similar effects of a more or less complete utilization of the plant may also be noted upon the operating expenses alone. Thus it developed in one investigation that the fuel cost per kilowatt-hour amounted to about 8 cents when the plant was operated at full capacity, about 1.5 cents when operated at 50 per cent of the capacity, and about 2.7 cents when operated at about 25 per cent of its capacity.

In another case, when both the fixed charges and the operating expenses were combined, it was found that the total cost per kilowatt-hour was about 1.5 cents when the plant was operated at full capacity; about 2.7 cents when operated at one-half, and 5 cents when operated at one-quarter of its capacity.

The figures for the cost of operation under different load-factors which have thus been given represent generating costs only. When the total cost is increased by all the remaining expenses these differences between the costs under high and low load-factors are considerably increased.

These facts have been cited because of their close relation to the rates that are charged for the services rendered. A high load-factor stands for low costs but a satisfactory load cannot possibly be obtained without rate schedules that for each branch and class of service are closely adjusted to the cost as is practicable under the circumstances. Under the varying forces that are now in operation in our business world it does not seem that the most advantageous loads could often be had under a uniform average rate which remains the same in all cases regardless of surrounding conditions.

Northwestern Cedarmen Change Name at Annual Convention.

The eighteenth annual convention of the Northwestern Cedarmens' Association was held at the Hotel Delta, Escanaba, Mich., on January 27 and 28. In line with the usual custom the meeting was well attended by the leading white-cedar producers of the northern tier. M. C. Moss, president of the Association, in calling the first session to order Tuesday morning, briefly reviewed the course of events in the cedar industry during the year. In 1913 there had been little of unusual development to record, either in cutting or in sales. Stocks were probably lower than heretofore. Business had been comparatively quiet, but the indications pointed to a better condition both as respects demand and price in the early future.

N. E. Boucher of Minneapolis, secretary of the Association reported that one new member, the Bell Lumber Company of Beaver Dam, Wis., had been received and that five companies had resigned because of not handling cedar products. Matters looking to reduction of freight rates had received constant attention. The Committee on Change of Name reported through its chairman E. L. Clark of the Valentine Clark Company, who recommended that the name of the Association be changed to "Northern White Cedar Association." This, he said, would definitely specify the character of the cedar handled by the northern producers as distinguished from the Western red-cedar handled by the Western Red Cedar Association. After some good natured opposition on the part of H. F. Partrige the change of name was decided upon practically unanimously. On Tuesday afternoon F. P. Vose of Chicago, secretary of the Electrical Credit Association of Chicago explained the plan and scope of the Credit Association work. A. O. Kuehmsted, president of the Credit Association, also spoke.

The eighteenth annual banquet was held in the large dining room of the New Delta Hotel. At the close of the festivities the Escanaba men were tendered a vote of thanks. A pleasant feature of the banquet entertainment was the impersonation by Charles Goodwin, a local lumber-mill operator and cedar producer, of a French Canadian lumber jack who forced his way into the dining room and insisted upon sitting at the guests table. After several recitations in dialect the make-up was removed and his identity revealed. Another feature of the entertainment was the singing of Joseph A. Naugle.

Tht Minnesota members of the Association were given permission to use the name of the Association in bringing suit against the railroads to recover the difference between the rates charged for shipping poles and posts, which are not at present included in the lumber schedule.

Upon the suggestion of E. L. Clark, a guarantee fund was subscribed to participate in the forest products exposition at Chicago and New York in the event of the committee specially appointed deeming it expedient to establish an exhibit of Northern white-cedar products. The Committee is composed of E. L. Clarke, L. A. Page, W. S. Thomas, J. C. Kirkpatrick, W. P. Bowring and H. S. Gilke.

The following officers were elected for the ensuing year.

President, J. W. Benham, Naugle Pole and Tie Company, Chicago.

Vice-president, L. A. Page, Jr., Page & Hills, Manneapolis, Minn.

Treasurer, W. B. Thomas, White Marble Lime Company, Manistique, Mich

Directors for two years, J. E. Gerich, McGillis and Gibbs, Milwaukee, Wis.; M. J. Bell, Bell Lumber Company, Beaver Dam, Wis.; L. A. Furlong, Valentine-Clark Company, to take place of E. L. Clark, resigned.

THE RELATION OF THE BUREAU OF STANDARDS TO THE PUBLIC SERVICE COMMISSION.[1]

By Edward B. Rosa.[2]

Many of the state railroad commissions have been transformed into public utility commissions, and given wide powers and responsibilities in connection with all public utilities. The intelligent exercise of these new functions involves an intimate knowledge on the part of the commissions and their engineers of a great many phases of engineering, electrical, mechanical and civil engineering, as well as gas engineering, telephone engineering, etc., together with the business methods and requirements of these various industries. Some of the problems are highly technical while at the same time very concrete and practical. The Bureau of Standards has been making a study of some of these problems, partly in response to a demand from the state commisions and cities which (in the absence of state commissions) regulate their own utilities, and partly in response to a demand for information from the operating companies and from engineering societies which are largely made up of representatives of such companies.

One of the investigations that has yielded results of great practical importance was concerning the electrolytic corrosion of gas and water pipes and lead cable sheaths by earth currents due to electric railways. The Bureau has made a very thorough study of the various proposals that have been made for applying protective coatings to such pipes and also of protecting them by bonding to negative busbars and by using insulated negative feeders from track itself. In the course of this investigation the engineers of the Bureau have made field examinations in many cities, both large and small, and with the co-operation of the gas, water, telephone and railway companies examined the pipes and made electrolytic surveys of earth currents. A complete system of electrolytic mitigation has been worked out for two cities and is being put into operation. The work has progressed far enough to demonstrate that the method may be successfully applied in many cases. This is a matter of great practical importance because hundreds of millions of dollars' worth of underground pipes and cables are subject to damage by electric railway current, and we believe the public service commissions can render a great service by seeing that the railways take such precautions as to reduce this damage to a minimum. Such questions should be kept out of courts entirely, and we believe that when the engineering aspects of the subject are better understood, street, railway companies will generally be ready to co-operate with the public service commissions, and to remove as far as possible, the cause of the trouble. In two of the cities studied by the Bureau, it was found that the saving of electric power effected by the methods of mitigation proposed was enough to pay a fair return on the entire cost of the changes and new construction required, and the system will be in better operating condition for the change. The work was conducted as a scientific investigation, although it was done in a thoroughly practical way and conclusions verified by frequent reference to working conditions.

Another investigation of great practical importance recently undertaken is on the life hazard in electrical work. There is great need of improvement in many respects in electrical practice, to reduce the danger to linemen, station employees, operatives of electrical machinery and the public generally. Manufacturers can help by impoving the design and construction of certain kinds of apparatus; constructing engineers can help by using better materials in many cases and installing dangerous apparatus with greater thought of the life hazard; operating companies can help by educating their employees and by adopting stricter rules for their protection and providing them with more and better safety appliances; public service commissions and city authorities can help by adopting better regulations and having frequent inspections; the press can help by creating public sentiment in favor of attaching greater value to human life, and warning the public of the danger. The operating companies and electrical engineering societies will cordially assist the Bureau in this investigation, and we hope to place some preliminary results in the hands of the public service commissions at an early date.

Another investigation of practical bearing to the public service commissions is on the instruments used in electrical measurements, and the methods of testing. The traveling inspectors employed by the state commissions render the companies and the public great service by checking up the master meters of the stations. These meters are usually not very portable, and traveling inspectors who are prepared to test them and to give local inspectors information render an important service.

These are some of the questions that the Bureau of Standards has been studying recently which come within the scope of the state public service commissions. For the lack of a sufficiently large scientific and engineering staff, we have been unable to do as much as we could wish, and have been unable to give the assistance to some of the state commissions which we have been asked to give and should have been very glad if possible. We hope that by another year our resources will be greater, and that we can take up in a thorough and scientific way many other problems connected with the public utilities.

One of the most serious objections that has been urged to the regulation of public uitilities by commissions is that if the same rate of return on the capital invested is allowed to all companies, it removes in many cases all incentive to the responsible officers of utility companies for enterprise, hard work and economy, and that in consequence both the public and the stockholders are losers and great injury is done the industries. As yet so little experience with rate-making has been had that one cannot say perhaps whether this has already occurred in some degree or not.

The California legislature recognized the importance of the matter and provided for it in the public utility act of 1911 in the following paragraph:

"Nothing in this Act shall be taken to prohibit any public utility from itself profiting to the extent permitted by the commissions, from any economies, efficiencies or improvements which it may make, and from distributing by way of dividends or otherwise disposing of the profits to which it may be so entitled, and the Commission is authorized to make or permit such arrangement or arrangements with any public utility as it may deem wise for the purpose of encouraging economies, efficiencies, or improvements and securing to the public utility making the same such portion, if any, of the profits thereof, as the Commission may determine."

The State of Idaho embodied the same paragraph in its recent public utility law, and the still more recent Pennsylvania law expresses the same idea in the following language:

"It shall be lawful for every public service company to participate, to such an extent as may be permitted by the commission, and deemed by the commission wise, for the purpose of encouraging economies, efficiencies or improvements in methods or service, in additional profits which may be afforded by such economies, efficiencies or improvements in methods or service."

These are clearly just and wise provisions if they can be realized. But

1 Portion of paper read at convention of National Association of Railway Commissioners.

2 Chief physicist, Bureau of Standards.

the question at once arises, how shall the public service commission decide whether a given company has made such economies, efficiencies and improvements as to entitle it to additional profits? Of course the company would in each case supply the commission with all the data desired, but it will be difficult to decide whether the facts prove their contention, and what is a proper allowance in the dividends for such economies and improvements. Certainly the commissioners themselves will generally not be able to do this without the services of able engineers who know all phases of the business (gas, water, electric light, telephone, street railway or whatever it may be) and who can judge the performance of the given company by the performance of other companies working under similar circumstances. In other words, standards of efficiency and economy must be set, and a given company claiming to have comsiderably exceeded the average and asking to be allowed to pay a higher than the normal dividend must be judged by such standards. On the other hand, if a company is poorly managed, its performance will appear so by the same standards. Such a system would tend powerfully to promote economy and enterprise, and yield large benefits to the stockholders and the public. It is a flexible and just sliding scale, but to carry it out successfully requires an exceptionally well equipped commission. Its realization would certainly constitute a long step toward the scientific regulation and control of public utilities.

But few commissions can maintain engineering staffs large enough and able enough to do all that is required to realize such a scheme. If, however, the states could co-operate effectively in this work, so as to utilize their combined resources most efficiently, and with the Federal Government assisting, it is possible that standards of economy and efficiency could be set and operating data determined that would be of vast service, not only enabling the commissions to act more intelligently and more justly but also (what is greatly to be desired) secure greater uniformity of action among the various commissions. The Bureau hopes to be in position soon to do something in this direction.

The change in recent years in the attitude of the public, the courts and the utility companies themselves toward the question of the responsibilities of public utilities to the public and their regulations and control by public service commissions, is nothing short of revolutionary. On all sides it is admitted not only that the public has the right to regulate and control but that the commissions can and do perform this difficult and responsible function justly and successfully. It is a remarkable tribute to those state commissions which in recent years have been acting as general utility commissions that in so short a time the justice and success of such regulation should be so generally admitted. But this success was not attained without effort. The highest constructive ability has been displayed, and earnest thought and hard work put into the task to achieve such success. To carry forward and develop the work in all the states will require the same constructive ability and the same earnest thought and hard work as have been displayed by those who have pioneered the movement. Without it failure may follow with a reaction in the public mind concerning the success of regulation by commission. With it success is assured from the outset, and success in far greater measure than has yet been realized anywhere. The benefits are not merely the material advantages accruing to the utilities and to the public which is served by the utilities, but also to the cause of good government and business and political ethics. The possibility of realizing business-like and efficient municipal government is enormously enhanced when the public utilities are taken absolutely out of politics and they are conducted and controlled on a high ethical plane. To the realization of such ends state and federal agencies should work in harmony and with enthusiasm, inspired by the success of the past and the possibilities of the future.

It will be seen from what has been said that the relation of the Bureau of Standards to the public service commissions is unlike that of the Interstate Commerce Commission in some respects and like it in others. It is like it in representing the Federal Government and in co-operating with the state commissions and striving to bring the latter closer together. But it has no legal authority over the utilities, holds no hearings of complaints, and renders no binding decisions. Its work is primarily scientific investigation, some of which is theoretical and refined (such as fixing of primary standards and methods of measurement) and some is very practical and concrete, and includes many of the most interesting problems of present-day engineering. We believe that there is an immense opportunity for usefulness in assisting to solve some of the problems presented by the public utilities, co-operating in this work with the state commissions and assisting them so far as possible to get full and reliable information, but not assuming any responsibility that belongs to them nor interfering in the slightest degree with their freedom of action.

Fixture Design Discussed in Pittsburgh.

Two papers were presented before the Pittsburgh Section of the Illuminating Engineering Society on January 16: "The Relation of the Illuminating Engineer to the Problems of Fixture Design," by A. B. Wilson and F. J. Blaschke; and "A Photometric Analysis of Diffusing Units with Varying Indirect Component," by E. B. Rowe and H. H. Magdsick.

As a preliminary to the papers of the evening, M. Lukiesh discussed the principles of the reflection of light as applied to colors, illustrating with lantern slides and with a number of tables the reflection and lack of reflection of colored light from various colored surfaces. This is a subject which has been largely neglected in illumination design, as has also the relative intensity in different parts of a room. The arrangement of brightness in the room will in the future form a large factor in determining the aesthetic quality of room decoration.

Mr. Blaschke defined a lighting fixture as an apparatus which supports a light source and whatever appurtenances are employed to direct or control the light. The primary object of a lighting installation is to provide light enough for one to see with ease and comfort. To the uninitiated this would seem a simple matter, but upon closer study the question reveals the difficulties involved in the determination of quantity, quality, direction, intensity, control and numerous other factors.

The elements of efficiency and decorative value must be combined in their correct proportions when applying illumination. Although not of equal importance, both these elements must be duly regarded if the most satisfactory results are to be obtained. The efficiency can be expressed in cold figures; decorative value and appearance are matters of taste and appropriateness and the designer must consider the idiosyncrasies of the probable purchaser of the product. The engineer should be able and willing to see beyond the plain data obtained by means of a photometer and a wattmeter. Fortunately we are not so devoid of appreciation of the beautiful or so mercenary as to measure merit in dollars and cents alone.

Since scientific lighting began to command the attention it now receives, the usual order of procedure has been to suit to the light source the other factors in a complete lighting installation. Reflectors, diffusers and fixtures have been designed mainly with a view toward accommodating a given size or capacity of light source, and in many cases, with a possible exception of the

purely decorative installation, the customary procedure is logical. With improved light sources, notably the tungsten lamp, a scientifically constructed lighting unit was instrumental in bringing about early commercial success; and to utilize this illuminant economically the question of reflector design was attacked with such interest that competition became more keen among the champions of various distributing media than among the producers of lamps.

The selection of units that are not only suited mechanically but also answer the requirements from an artistic standpoint, falls largely to the illuminating engineer. The use of fixtures entirely out of harmony with other surroundings, even by the most inexperienced amateur, should be considered inexcusable; but unfortunately the combination of glassware with supporting devices never intended to be employed in conjunction therewith is frequently condoned. Perhaps in the future, designers will be able to prevent the misapplication of their products by specifying what combinations are permissible.

When fixtures are designed for the homes occupied by people of moderate means the style must necessarily lean toward the conventional and, although still a second consideration, the efficiency of the complete lighting unit must be given attention. In the case of industrial illumination, principally in the lighting of shops and factories, efficiency is of major importance. Where the designer is called upon to plan fixtures to complete a scheme of decoration he should sacrifice nothing for efficiency. The cost of operation in such instances is not of such vital importance as it is to the householder of limited means, and therefore the fixture designer should not be compelled to work under the handicap offered by an anticipated test of watts per square foot. Unorthodox as it may seem, it is true that in some instances the illuminating engineer takes no part in the fixture designer's work other than to determine the amount of light required on a given plane. Consultation should not be postponed until all other details have received attention.

Among the results due to the reduction in the cost of light, that is, particularly in the cost of providing the light source itself, is the extensive development of apparatus for applying light indirectly. Only in rare instances where natural conditions are favorable can indirect lighting be accomplished without the use of directing and diffusing media. Before the present high-efficiency light sources were developed, the necessity for directing and diffusing media was not realized to the extent it is today. The argument that such equipment would serve as a protection to the optic centers as well as increase the efficiency of the lighting unit could formerly not be consistently proved. The high intrinsic brilliancy of modern units, however, made evident the necessity for protection from direct rays and opened the way for the development of apparatus that would make it possible to utilize under proper hygienic conditions the greater part of the light produced. As a device that fulfills both demands, the semi-direct unit has been advanced.

The second paper was read by Mr. Magdsick.

In spite of the rapidly increasing use of glass bowls in which a considerable part of the total light it utilized indirectly with a smaller proportion of direct transmitted light, very little photometric data on the performance of these units seems to be available. The authors of the paper have therefore made a photometric study of the effect on the shape of the distribution curve and on the proportion of direct and indirect light due to variations in the contour of the glassware, the number and arrangement of lamps and some of the different kinds of diffusing glass which are now in commercial use.

One ever present difficulty in studying and classifying data of this nature is the differentiation of the so-called "opal" glasses. There are numerous methods by which such classification might be made:

First, on the basis of chemical composition.

Second, on the structure of the glass, as determined by micro-photographic tests.

Third, on diffusion characteristics, that is, the amount of transmitted and reflected light, absorption, etc.

Fourth, on the photometric performance of the glass in some standard reflector shape.

Fifth, on the basis of appearance by reflected or transmitted light, or both.

At present a rigid definition which would enable one who is reasonably familiar with illuminating glassware to grasp the fundamental characteristics of any unit without inspection or detailed description is lacking.

Tests were made on units of different contour and density of glass to determine the effect of different lamp arrangement, density of glass, contour, effect of chain interference and a symmetrical distribution from lamps and the variations caused by changes in lamp position with reference to the bowl.

For the range of conditions covered by these tests it was found: first, that the position of the lamp with reference to the bowl is an important factor in determining the distribution of light; second, that the results secured with various lamp arrangements are similar except in the case of a single pendent lamp, which gives a more extensive distribution than other arrangements; third, that the variation in total absorption of the various glasses is slight, but that the distributions secured differ widely; fourth, that the principal effect of variation in contour is to distribute a relatively larger proportion of the light in the 0°-60° and the 120°-180° zones as the diameter of a bowl is increased relative to its depth; fifth, that the appearance of the units is satisfactory in practically all instances.

The discussion was participated in by E. B. Rowe, C. O. Bond, M. Lukiesh, A. L. Powell, S. G. Hibben, G. H. Stickney, J. R. Cravath, T. W. Rolph, F. J. Blashke and Ward Harrison.

Mr. Bond suggested that a distinction be made between members of the Society: (A) professional illuminating engineers and (B) those laymen who are interested in illuminating engineering. Some of the colleges, or the committee on education should outline a curriculum, or certain standards to which a member must conform before he can be qualified as an illuminating engineer. He announced that the next annual convention of the Society will be held in Cleveland in September. He asked for a definition of a limit of intrinsic brilliancy—is it a certain value per square inch or is it relative, with respect to the background?

Mr. Lukiesh stated that no definition of glare is possible, as it is mostly a matter of contrast. A bare incandescent lamp, held towards a clear sky, will produce no sensation of glare. Present practice along this line appears to be entirely satisfactory. The lighting expert must become more of an artist than he has been. The consumer must either depend upon his own judgment, the reputation of the manufacturer, or the judgment of the salesman. The latter usually knows little about illumination, but prefers to talk about periods, etc. To secure the best results in general illumination, the educational committee should endeavor to train the fixture salesman, who will then furnish useful information to the customer, instead of talking about beauty, periods, etc. A lighting device cannot be really beautiful unless it is truthful and useful.

Mr. Hibben showed the results of a series of tests on indirect bowls, showing that with medium-density glass the transmitted light exceeded the reflected—hence more light is secured when the reflector is hung low. With a denser glass, the reflected light is in the preponderance, and more light is secured by hanging the bowl near the ceiling.

Discussion of Subways and Railroad Terminals in Chicago.

The joint meeting of the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers, that was held on the evening of January 26 was the largest ever held in the Society's rooms. About 350 men crowded the auditorium library and committee rooms. R. F. Schuchardt presided. The election of officers for the Electrical Section of the Society resulted in the choice of F. J. Postel as chairman, H. M. Wheeler as vice-chairman, and E. W. Allen as member of the executive committee.

Bion J. Arnold, past-president of both organizations, was the principal speaker of the evening, taking as the subject of his illustrated talk "City Transportation, Subways and Railroad Terminals." This topic is now of very live engineering and pubic interest in Chicago and accounted for the large attendance.

Mr. Arnold opened his remarks with a reference to his 1902 report to the Chicago City Council on transportation problems. An attempt was then made to enlarge the authorized bore of the Illinois tunnel system, of which about six miles had been built under downtown Chicago streets. No good reason being given for this, he reported adversely on the request and the system was therefore extended on the original plan, totaling now over 60 miles of tunnels. The top of these tunnels is 33 feet below street surface. By special construction two superposed intersecting lines of subway can be built in space between Illinois tunnels and street surface, except at a few points where the tunnel roof will have to be altered.

In a more extended report made by Mr. Arnold in 1911, from which he quoted and showed many maps and diagrams, the principles that should govern in subway planning were laid down. Construction was recommended in several steps, of which the initial one was practically the same as the one recently recommended by the Board of Supervising Engineers. The routes and work proposed in this initial step form a nucleus to which can be added from time to time extensions and additions to make a comprehensive system of subways covering ultimately the main arteries in all parts of the city.

Mr. Arnold showed that the various steps in construction can be arranged to relieve not only surface congestion, but also that on downtown elevated railway lines and ultimately sufficient subways can be built to form a complete system of lines in which would be confined long high-speed express trains receiving traffic from points immediately adjacent thereto and from local surface car feeders. None of the subway lines proposed by the Board interfere with such development. The arrangement of stations was shown for two-track and for four-track subways, both single-deck and double-deck at intersecting points to avoid grade crossings. In any subway construction provision must be made for utility galleries to take care of water, gas, electric and other utility pipes and cables.

The very high investment involved in subway construction is justified only for running frequent, long and high-speed express trains, or where extreme congestion necessitates it. Outlying districts cannot develop sufficient traffic to warrant subway lines for many years; therefore initial work should aim to relieve the most congested streets. To build a subway costs three to four times as much as an equivalent elevated railway. The growth of Chicago surface-line traffic at present is at a rate of doubling itself in about 13 years.

Mr. Arnold concluded his address by speaking briefly of the need for rearranging the location of Chicago trunk railway terminals in order to permit the central business district to expand unhampered and to utilize more intensively the great area of central railroad property. He urged straightening of the river to open more streets and suggested that the railroads electrify and develop their suburban traffic by through-routing in separate subways.

In the discussion which followed the address, many questions were asked. Mr. Arnold said the financing of subway construction by special assessments on the property benefited is a very just and equitable plan, but unfortunately unpopular. However, two subways are now being built in San Francisco to his plans and the entire cost is borne by special assessment. James Lyman pointed out the increase in capacity that electrification would give the railroads. E. N. Lake spoke of extraordinary capacity of the new high-speed Boston subway running to Harvard Square, in which long trains with three-door cars are used. Mr. Arnold said that from the investment standpoint it is profitable to invest $2.50 to $4 for each dollar of gross receipts in surface traction lines, $4 to $6 per dollar of gross receipts in elevated lines, and $8 to $10 per dollar of receipts in subway lines. This distinction comes from the possibility of running longer trains at higher speed and with fewer employees, so the operating costs form a smaller percentage of gross receipts than with surface lines.

Planning Lighting Installations.

A joint meeting of the Chicago Section of the Illuminating Engineering Society and the Chicago Architects' Business Association was held on the evening of January 27 in the Art Institute, Chicago. Meyer J. Sturm presided, and the attendance was in excess of 100.

The principal paper of the evening was by J. B. Jackson and was entitled "Planning Lighting Installations." This paper took up the fundamental considerations affecting proper illumination of buildings, pointed out how proper results could be realized by attacking the problem in the right manner, gave data applicable for the determination of the proper intensity of illumination, the best arrangement of lighting units, the constants of electric incandescent lamps and the proper factors for taking into consideration, the reflecting power of walls and ceilings with different types of finish, when using different types of reflectors and glassware. The paper wound up by giving in definite order the proper steps to be taken in planning a lighting installation and a numerical example was worked out along these lines.

After a long business meeting by the architects, a talk on the fundamentals of illumination was gvien by William A. Durgin. This was one of a series of talks which is being given at the monthly meetings of the Chicago Section. Mr. Durgin dwelt especially upon the distinction to be made between intensity of the source, intensity of illumination and density of luminous flux. He carried out experiments to demonstrate the meaning of each one of these terms, and to show the values of the units of measurement, the candle, the foot-candle and the lumen.

There was but little discussion, the chairman calling only upon A. J. Sweet, of Milwaukee, who presented a brief statement of the ideals of the illuminating engineer, which are not merely to achieve efficiency in the utilization of light sources. He is also concerned with hygienic features, even more than with commercial features. He spoke briefly of the physiology of the eye and the great increase in its use in modern times, with the result that eye troubles are increasing at a tremendous rate. He pointed out the value of light in bringing out the features of architectural detail.

Some lantern slides of typical lighting installations were shown by H. B. Wheeler and F. K. Pinckney.

The next meeting of the Chicago Section will be held at Sears, Roebuck and Company on the evening of February 11. S. E. Church will describe the lighting installation in the company's buildings.

Lackawanna Extends Wireless System.

The Delaware, Lackwanna & Western Railroad is constructing additional wireless stations at Lake Hopatcong, N. J., and at Bath, N. Y. The former is 46 miles from New York City and the latter, 100 miles east of Buffalo. When these stations are completed they will, with the stations already in operation at Scranton and Binghamton, provide for radio communication over the entire line with such trains as are equipped with wireless apparatus.

Both the east and west-bound Lackawanna limited trains will begin to handle commercial messages as soon as these stations are completed.

On January 24 a special train carried members of the American Society of Civil Engineers over the road from New York City to Nicholson, Pa. While this train was running at high speed, communication was held with the officers of the railroad in New York City, and with the *New York Times* by means of the wireless apparatus. Messages were communicated to the wireless station at Scranton and from there relayed by wireless to the station in the Woolworth Building, New York City. The trip of the civil engineers was for the purpose of inspecting the viaduct at Tunkhannock, which forms what is known as the Clark Summit cutoff. This has been erected at a cost of $12,000,000 and is the largest concrete viaduct in the world. It is 2,375 feet long, with 12 arch spans, and has a height of 242 feet above the stream which it crosses.

The Importance of the Current Strength On Brass Plating.

The strength of the current on brass or bronze plating is an exceedingly important portion of the operation, and lack of uniformity or means for regulating it is frequently the cause of failure in this important portion of the plating business. Not only is the maintenance of a uniform current necessary, but means for regulating it must be had. A dynamo may give a certain voltage while the brass tank is running, but if it drops when other tanks are thrown in, then it will not give good results in brass plating.

In brass plating the color of the brass deposit is paramount to everything else, and unless this color is maintained from day to day the work cannot be used. To obtain this color, which is usually an ordinary yellow brass, the current must be obtained with the greatest uniformity. There is always a certain current-density, indicated by the voltage, that will give the desired results, and this density must be maintained.

The manipulation of a brass solution is not difficult, contrary to the usual belief, when a uniform and proper current strength is obtained. It is known that too little free cyanide, so that the anodes coat over, causes a variation of color on the work, and so that copper, bronze, brass and zinc will often be deposited on the same article. The addition of a little cyanide, so that the anodes remain clean, is all that is required to correct this trouble. It is known that a brass solution that does not deposit its metal completely on an article is too lean in copper and zinc and must be built up with more carbonates. Too much gas given off from the work being plated indicates too strong a current, and if the deposit that forms is thin then too much free cyanide is present. Color is easily regulated by the addition of copper or zinc, as the case may demand.

After all these points have been corrected, however, nothing will be accomplished unless a uniform current is obtained. A suitable dynamo is necessary. One which shows a drop in voltage to a considerable extent when an additional tank is thrown on the line and cannot be restored is unsuitable for brass. A suitable rheostat is likewise essential for a brass solution, for the reason that while the dynamo may give a constant output, it may be (and usually is) of too high a voltage. It must then be reduced by a suitable rheostat. There is always one voltage that is right, and this must be obtained by means of a suitable rheostat.

In successful brass plating, therefore, it is essential that a dynamo be had that will give a uniform and full strength of current, and that a suitable rheostat be used which will enable one to cut down the current to the right quantity for producing the desired brass color. The successful brass platers have this equipment. —*Brass World.*

Western Inspectors Convene At Cincinnati.

The ninth annual convention of the Western Association of Electrical Inspectors was held at the Hotel Gibson in Cincinnati, O. The three-day convention began Tuesday morning, January 27, with a good attendance. President Ben W. Clark presided. Many important electrical inspection problems received careful consideration and free discussion. Revision of the association's constitution and by-laws was considered. A full report of the sessions will be given in our next issue.

The inspectors traveling by way of Chicago occupied a special car which left Chicago on Monday night. Monday afternoon was spent at the Underwriters' Laboratories, where some special tests were carried out under the direction of B. H. Glover, assistant electrical engineer. In the evening there was a theater party.

NOTES ON WAR ENGINEERING.

By P. S. Paganini.

The scientific improvement, of the last 25 years have increased and multiplied the importance and responsibilities of the engineering corps of an army far beyond the knowledge of the layman. To the past and still extant duties of bridging, road-making and position work in their different branches has been added all the service of sanitation, water supply, draining and the most important service of communication, either on the field or on the rear ways.

The engineering corps of an army, recruited on the basis of universal short service, consists in a general way of a highly trained set of officers, educated in special technical and military schools, and of a corps of non-commissioned officers, chosen among the trained privates, and who are kept as long as is possible in service by comparatively high pay and reenlistment premiums.

Privates are chosen among the men, who when presenting themselves for service are found to have previous training in skilled trades or some mechanical knowledge; or, if the quota of this kind of recruits is low, among men, by previous education or general appearance of inteligence and brightness, are thought to be capable of a quick development.

The shortness of their enlistment term requires a very intensive training and taxes to the utmost the ability and patience of the officers and noncoms, who every year find themselves obliged to deal with perfectly raw material, while at the same time continually losing their trained men by legal discharges at the end of service. Incidentally, it may be said that while much is as yet to be done to have all the apparatus with which army engineers have to deal, made practical for any kind of service under any kind of conditions, they are at present far superior in efficiency to the class of men that come in the natural order of things to handle them, and probably to this is to be atributed half of the breakdowns which occur in field service. Moreover, the short-service man of the fighting arms, owing to the length of his staying with the colors, is trained only for the business of fighting and he is absolutely helpless and hopeless in any other kind of work; and any other kind of work he dislikes and refuses to do, and that adds to the engineer's lot a large amount of details which in earlier times were taken care of by the fighting units.

In the late Turkish-Italian war, the

service and continuity of communications was obtained by the separate and combined use of telegraph and telephone companies with packs wireless and heliographic units, searchlight sections supplemented by motorcycles, bicycles and mounted orderlies. Telegraphs and telephones were used for permanent or semi-permanent work in and around fortified positions; telephones for field service; wireless for communication between the bases and detached columns, or between the colony and the mainland. On this service heliograph showed up very well and searchlights were used quite exclusively for the night explorations of the ground around fortified positions or at the outposts. These seemed to be more useful to blind the enemy and conceal the position when thrown across their line than for finding purposes, as the observer is practically blinded if not kept quite away from the searchlight rays; and if kept too far away he is apt to lose his working connection with the searchlight operator and be handicapped by a sudden shift or disappearance of the light.

The telegraph and telephone companies did a large amount of permanent work, from the begining of the war in September, 1911, to early in 1912. They enacted around Tobruk 40 kilometers of line, with 60 kilometers of wire, part on the ground, or under, with insulated and armored cable, part above ground with bare wire on light posts. Around Bengase, 132 kilometers of line; around Tripoli, 195 kilometers of telegraph and 40 kilometers of telephone lines, part under ground and part above, with 50 telegraph and 50 telephone stations and with an average of 2,000 messages per day.

The telephone was found indispensable and absolutely reliable during actions. The commanding officer was kept in constant touch with his report commanders. Any shifting of headquarters was quickly followed by the relaying of the wire by a second pack section while the first was engaged in taking up its own laid wire and getting ready for future work. No wire was ever left on the field, except for short lengths, or in case of retreat. At the outposts the telephone was found in some cases dangerous, as the ringing was apt to disclose the location of the outpost. Not much trouble was had by wire cutting, only by cable chafing on very hard and rocky ground, but grounds were easily discoverd and remedied. Friendly natives interfered somewhat with operations by excess of zeal in trying to get the laid cable out of the way of marching troops. The most useful and mobile pack section was found to consist of a cable cart and instrument cart, the lumber carriage being quite too long and heavy for quick movements. Undoubtedly the greatest advantages of the telephone in comparison with any other system of transmission of messages are its quickness and mobility.

Wireless telegraphy had a thorough try out. In October, Tripoli was in constant communication with the fleet outside the harbor, in November with Augusta (Sicily), about 400 miles away. Slowly the number of permanent stations were increased to eight and some 31,000 messages were exchanged and very little trouble was given by atmospheric conditions. For field service, its advantages in comparison with the telephone are; (1) cannot be cut by enemy; (2) any flank move can be made without relaying of wires; (3) it is not necessary to traverse the country between two points to obtain communication between the two points. Its disadvantages are; (1) slowness (2) interference; (3) inability to preserve secrecy. Remedies were found in using ciphers; by using the apparatus of different stations only at determined periods on the hour; by changing the wave length of transmitter from one fixed wave to another, after stated periods of time. The enemy not being very well supplied with strong apparatus, not much experience was had on what troubles interference from his side would have caused.

Owing to the sandy and rocky nature of the ground in Lybia the wagon and lumber section adapted to the good metal road of the continent, were found to be too heavy and it was necessary to have recourse to the pack mules or carrier camel sections. That decreased the practical range from 200 to 50 miles, as the weight and consequently the power of the engine had to be kept down to possible pack board. The only improvement in range was through a lengthening of the masts, which if too high would have required a complicated mast gear and lifting arrangement.

A typical pack station is made up of four loads; (1) the engine-dynamo load (the pack saddle which can be lifted and ready on the ground in one minute serving as bed plates for the generating units; (2) the instrument loads, in three cases—transformer, primary oscillating circuit, receiver with accessories and tuning testers (connections between the units being made automatically when the cases are piled on top of each other); (3) masts and earth, and (4) ma.t gears and antennae. The stations can be ready for transmitting in about 20 minutes. The masts not being generally longer than 30 feet are put together laying on the ground and then upended like a ladder. No load is larger than 200, the generating set of from two and one half to three horsepower weighing from 40 to 45 pounds. The electrical side is a one half kilowatt self-exciting low-frequency alternator, wired to give alternating for transmitter and a small supply of low-voltage direct-current for charging a small accumulator for the light in the receiver box.

Wireless was timed on an aeroplane, with good results as far as sending, but poor receiving, account of the noise. The apparatus weighed about 20 to 25 pounds.

Concluding the war was a thorough lesson in practical field engineering to the engineering corps, and future improvement of engineering materials for war purposes are expected to follow. Some have already been made. Only the other day a flying column was in touch with the supreme command after occupying Murzuk, a straight 500 miles as the birds fly. That would show a park station with a range of at least 200 miles, as that is the distance from the nearest station where a permanent outfit has possibly been established, and only camels were following the column.

Peoria Electric Show.

The Electric Show, which is to be held in Peoria, Ill., early in March of this year, will be conducted by the Peoria Electric Club. This organization meets twice a month on Saturdays for luncheon. The president is C. A. Hoppin, consulting engineer, and the secretary is E. H. Joseph, of the Electric Appliance Company.

The director of the show is T. D. Buckwell, manager of the Central Illinois Light Company.

The Electric Club is composed of representatives of all the various electric industries in the city. There is thus no doubt but that the Electric Show will be a success both as to the number of exhibitors and attendance from both the city and the surrounding towns.

On the evening of Friday, March 13, the Jovian Order will hold a rejuvenation in charge of Statesman E. R. Elam.

Society for Electrical Development.

The Board of the Society for Electrical Development met in New York City on January 26 and discussed a number of very important matters relating to the welfare of the Society. Fifteen directors were in attendance. Reports by the general manager and by the secretary-treasurer covering operations to date were read and accepted. Stephen L. Coles was made secretary-treasurer. The meeting adjourned to February 17.

New Electrical and Mechanical Appliances

American Production of Tungsten Ores in 1913.

Tungsten ores were produced during 1913 in six of the Western states: Colorado, California, Idaho, Arizona, South Dakota, and Nevada. According to preliminary figures collected by Frank L. Hess, of the United States Geological Survey, the production showed an increase over that of each of the two preceding years. The output for 1913 was equivalent to 1,525 tons of ore carrying 60 per cent of tungsten trioxide, and was valued at about $640,500. The production in the three preceding years was 1,330 tons, valued at $502,158, in 1912; 1,139 tons, worth $407,985, in 1911; and 1,821 tons, worth $832,992, in 1910.

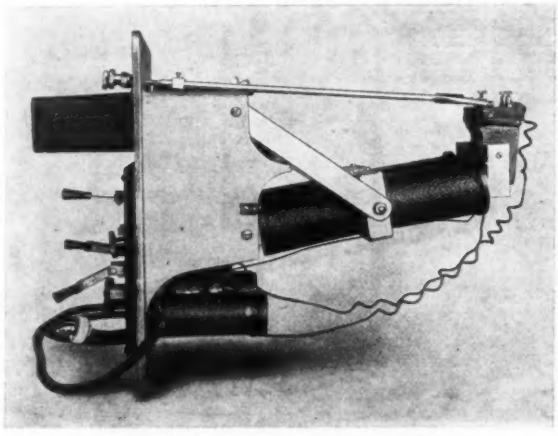
As heretofore, the Boulder County field, Colorado, was the largest producer, with an estimated output of 953 tons of ferberite in 1913, against 812 tons in 1912.

The Atolia district, California, was the second largest producer, and still makes a larger production of scheelite than any other district in the world. Nearly all the output was produced by the Atolia Mining Co., but small quantities were also produced from several mines at Atolia and the Stringer and Randsburg districts on the north.

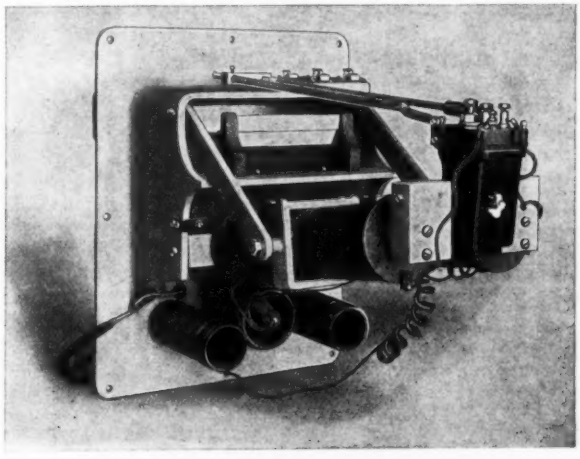
Some wolframite was produced in the Clark Mountain region, in southeastern California. In Arizona scheelite was produced in the Old Hat district, 40 miles north of Tucson. Other than the Atolia district, this is the only district in the United States from which a production of scheelite is made.

Some hübnerite was produced in the Arivaca region, near the Mexican boundary line, south of Tucson, and at Dragoon, east of Tucson. A little hübnerite was also produced at Round Mountain, Nev., and in the Blue Wing district, Paterson Creek, Idaho.

Prices were better during the year than in 1912 and ranged from $6 to $7.50 per unit of 20 pounds at tungsten trioxide.



Simplex Peak-Voltage Meter—Side View.



Simplex Peak-Voltage Meter—Rear View.

A New Form of Voltmeter for Measuring Peak Voltages.

In the testing of insulated wires and cables designed for a great variety of purposes a voltmeter often fails to measure adequately the stresses to which the dielectric is subjected. Based on the integration of the sine wave (on the square root of the mean square of instantaneous values) voltmeter readings give little or no indication of unusual peaks in the voltage wave or of surges in the circuit.

The need of an instrument which would give such readings arose in connection with the high-voltage testing of wires and cables, it being well known that in such tests the peak of the wave is what counts in breaking down the insulation. So long as a sine wave is maintained, the ordinary voltmeter indicates the peak voltage (a definite percentage above the voltmeter reading). But in cable testing there is a considerable charging current, due to the electrostatic capacity of the cable. As this current is likely to distort the wave form, the ordinary voltmeter may give no definite information as to peak voltage.

After trying and discarding both a spark gap, which proved to be too easily affected by outside conditions, and an oscillograph, which is too delicate an instrument for factory use, the engineers of the Simplex Wire & Cable Company, of Boston, Mass., proceeded to develop for their own use apparatus which would give the required results. Based upon the principle of the oscillograph, but with its movement confined to a straight line, the new instrument, illustrated herewith, indicates the peak of the voltage wave at the limit of oscillation along that line. It does not show the character of the wave or the form of its peak, but it does give very clearly the reading for that peak, whatever the shape of the wave may be.

This peak-voltage meter, in its original crude form, was used successfully in the Simplex factory for some time, and thus thoroughly tested out. It has just been completed in its present form, after an experimental period extending over two years.

The voltmeter, which is of switch-

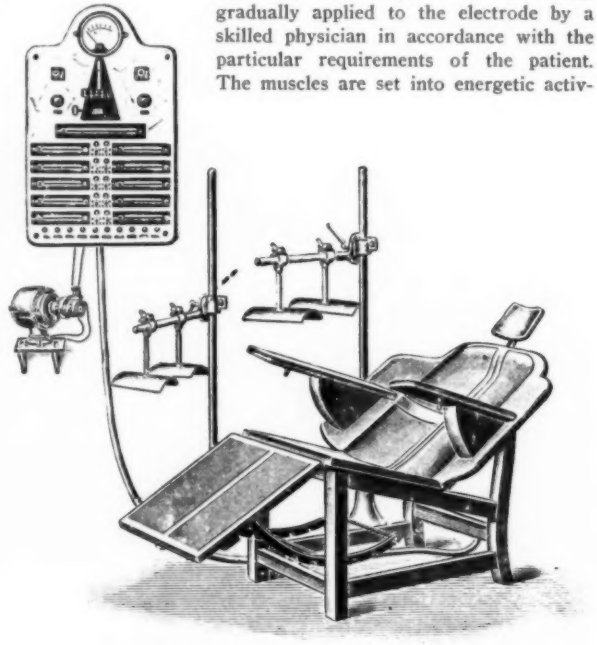
board type, measures about 10 by 12 inches on the front and 14 inches deep. It consists essentially of a heavy electromagnet, between the poles of which is located the vibrator. By a suitable arrangement of lamp, mirror and lenses, a beam of light is thrown on a ground-glass scale in front, graduated in volts. This instrument is connected, through a potential transformer, directly on the high-voltage circuit, the current being so small that the apparatus can be left in the circuit all the time. It can be quickly calibrated at any time by applying direct current of known voltage.

This interesting example of the development of an invention to meet a particular factory need might prove of considerable value in other lines as well as that of the manufacture of insulated wires and cable. But a striking feature of its development is that it shows the readiness of the American manufacturer to undertake both the deep study and the careful experimental work needed to provide him with the tools with which his regular work can be carried on to best advantage.

Simplex Peak-Voltage Meter Showing Control Board.

Electrical Apparatus for Treating Obesity.

The number of applications of electrotherapeutic methods is constantly increasing. One of the latest is its application in the treatment of obesity. This new method was developed by Dr. Bergonie, a French physician, who found that the muscles of the entire body could be compelled by electricity to perform energetic muscular work without the intervention of the will power of the patient. For this purpose Dr. Bergonie used a vibratory current generated by an induction coil. Although the treatment was found to be quite effective, the varying character of the so-called faradic current, due to the uneven action of the interrupter, was found to produce shocks and nervous effects that made the patient fidgety. To overcome this difficulty an improvement was devised by Dr. Nagelschmidt in which a constant direct current was used which was passed through a rotary commutator to produce an interrupted pulsating reversed current, the application of which to the patient is said to produce no unpleasant effects. In this manner stronger currents than heretofore can be employed without discomfort to the patient, which improves the effect and hastens the cure.



Chair for Electrical Treatment of Obesity.

The apparatus used in this treatment is shown in the accompanying illustration. The main portion of it is a so-called obesity chair, which is an adjustable operating chair provided with eight metal plates insulated from each other and serving as stationary electrodes for applying the current to various parts of the body. Two stands are provided, each with a number of movable electrodes by means of which the other side of the circuit is connected to any portion of the body, the current passing through the muscles from the stationary to the adjustable electrodes. The stationary and the adjustable electrodes are connected through a multiconductor cable to a compact switchboard on which there are reversing switches and control rheostats for each separate electrode, also a timing device called a metronome which periodically opens and closes the circuit to enable the muscles to recuperate for brief intervals. The source of current may be varied, either a direct current or an alternating current, of any voltage, which is passed through the proper transforming device to convert it to a direct current of relatively low voltage. This direct current is passed though a motor-driven commutator shown at the left in the illustration, which serves to produce an adjustable number of interruptions in this current, varying from 2,400 to 12,000 per minute. Thus in one adjustment the commutator makes 90 current interruptions per second and each current flow has a duration of one-twelve-hundredth of a second.

In carrying out this treatment the adjustable electrode is applied to the particular muscle or fat tissue that it is desired to work upon and the current gradually applied to the electrode by a skilled physician in accordance with the particular requirements of the patient. The muscles are set into energetic activity by this application of the current. When properly applied a patient's will is not called into action and the entire treatment produces no fatigue, even when continued for one hour. At each treatment the patient loses approximately one-half pound, so that within a week he becomes lighter by from four to six pounds. The functions of various organs of the body are also stimulated, particularly the heart, which in many cases of this kind has suffered. The method usually consists in 25 treatments, then an interruption of treatment for one to four weeks and then a second series of 25 treatments. The weight reduction is most noticeable during the earlier treatments.

The apparatus used in this method is made abroad and sold in the United States by The Sanax Company, Incorporated, 125 East Twenty-third street, New York City.

A New Cable Car for Hanging and Repairing Aerial Lead Cables.

For use in hanging and repairing lead-covered telephone and telegraph cable for overhead lines, the Fairmount Electric & Manufacturing Company, Philadelphia, Pa., has placed on the market a new cable car with many advantageous features. This car, known as the "Aero" car, is shown complete in Fig. 1. In Fig. 3 are shown the four parts of the car when it is "knocked down" for shipment. Fig. 2 shows the car in use.

The Aero cable car has been designed with a view to minimum weight and extra strength, weighing but 20 pounds complete. It is constructed entirely of cold-rolled steel and crucible steel castings, except the seat and pick-up roller, which are of oak wood. All metal parts are sherardized or rendered rustproof, which assures free working of all parts at all times.

The car is arranged so that it can be taken down in four parts, as shown in Fig. 3. The parts interlock in such a way that it is not necessary to take any of the bolts or nuts off when assembling or disassembling; since all bolts are upset, this prevents them from becoming detached and lost.

The wheels of the car, which ride on the messenger wire, are corrugated in such a way that they pass freely over any cable hook or hanger which is not possible with smooth-faced wheels.

There is an adjustment on the car that permits the height to be increased or decreased for a long or short-bodied man, respectively. The brace bar which runs across the back of the car can be adjusted to upper or lower position while the workman is using the same on a messenger wire. Fig. 1 shows this bar in its lower position and Fig. 2 shows it in the upper position.

Fig. 2.—Car in Use for Hanging Cable.

The attachment shown on the left on the car in Fig. 1 is known as the pick-up roller and can be adjusted to different positions (according to length of hooks or hangers used) so that the cable will be brought to the proper distance from the messenger wire, thus permitting the cable hooks to be readily attached. See Fig. 2. Without this pick-up attachment a workman is compelled to hold the cable in position for attaching hooks and cannot attach half

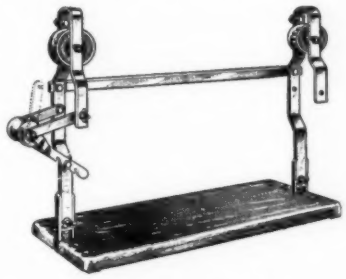


Fig. 1.—Aero Cable Car.

the number of hooks in a specified time as with the pickup attachment.

The minimum weight of this car and the small space occupied when knocked down for transport can be readily appreciated by telephone men, and permits, for instance, of one man placing the car and tools on a motorcycle and going miles into the country to repair a cable, which otherwise would necessitate two men and a wagon, or the shipment of car and tools and then hiring a team to haul the car and tools to the section where the trouble is located.

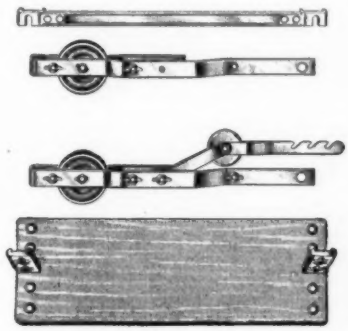


Fig. 3.—Parts of Car as Shipped.

Montana Copper Production.

The copper output of Montana declined about 9 per cent, from 309,738,873 pounds in 1912 to 280,658,000 pounds in 1913. This last was about 30 per cent less than the output of Arizona, the leading copper producer in 1913. The average price of copper decreased from 16.5 cents in 1912 to about 15.37 cents in 1913, and it is presumed that no efforts toward a record output were made by the larger smelting establishments. According to monthly printed statements, the Anaconda Copper Company was making an average of 22,000,000 pounds per month and the East Butte Copper Company about 1,125,000 pounds per month.

Motor-Driven Vegetable-Paring Machine.

The illustration herewith shows a motor-driven machine made for paring potatoes, etc., with the smallest waste and in the shortest time. This machine removes by friction the whole of the refuse or outer skin of potatoes, turnips, carrots, parsnips, etc., and turns them out perfectly peeled, smooth and clean in their natural shape and ready for use.

The machine is built in accordance with United States Navy specifications and is driven by an inclosed watertight, shunt-wound motor rated at one horsepower, 120 volts, 1,800 revolutions per minute. This machine has a capacity of from 10 to 25 bushels of vegetables daily. It is especially adapted for hotels, hospitals, sanitariums and shipboard use. Forty pounds of potatoes or other vegetables can be placed at one time in the hopper. The heights of the machine is 49 inches and it requires very little floor space, the base being but 19 inches in diameter.

Operation of the motor-driven paring machine is as follows: Start the motor, turn on the water, empty into the cylinder at one time sufficient potatoes (not washed or assorted) to almost fill it up.

The friction disk will at once cause the contents to take a rotary motion and come in contact with the diverter fastened to the cylinder, which will immediately cause the return of the potatoes, etc., to the center of the disk, whence they are again taken to the side of the cylinder, and so the movement of the contents repeats itself. During the whole time by gentle friction and rubbing contact with the disk, the outer skins only are being

Vegetable-Paring Machine.

removed without tearing, pounding or bruising the vegetables in any way, thereby retaining the greatest percentage of the most nutritious part of the vegetables. Water is constantly sprayed over them, which thoroughly washes and cleans them, and also carries off the parings, dirt, etc., from the machine through the waste outlet to the sewer.

When the vegetables are sufficiently pared, the door is opened without stopping the machine and it immediately empties the vegetables into the receptacle placed to catch them without throwing them all over the floor. The door is then closed and the operation repeated.

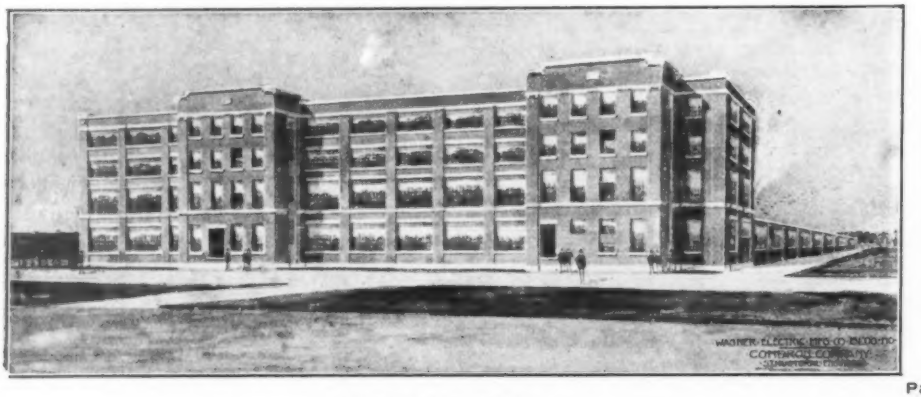
This machine is made by the American Paring Machine Company, Philadelphia, Pa. The motor illustrated is manufactured by the Diehl Manufacturing Company, Elizabeth, N. J.

New Building for Wagner Company.

The accompanying illustration is the architect's drawing of a new building to be erected at the Hillside Plant of the Wagner Electric Manufacturing Company, 6400 Plymouth Avenue, St. Louis, Mo., at a cost of $150,000.

This building is to be of reinforced concrete throughout. It will be four stories high, and cover an area of 272 feet by 45 feet. The building is to be used chiefly for the manufacture of the smaller products produced by this company.

When the building is completed about 400 people will be added to the pay roll of the company, which now employs, at its two plants, over 1,800 persons.



New Wagner Factory.

Anglo-Spanish Wireless.

The British Postmaster General has consented to a license being granted to Marconi's Poldhu station for the purpose of conducting a commercial telegraph service between England and Spain.

New Paiste Separable Attachment Plug.

Neatness and small size were made the features in designing a new separable attachment plug by the H. T. Paiste Company, of Philadelphia, Pa. An entirely new idea is the fiber washer which slips down the shaft and fits into a shoulder in the edge of the cap. This completely hides the ragged wire ends and is a protection from the dirt which collects there. When wiring the plug this washer is slipped off, leaving the contact screws exposed and easy of access. A strain relief makes an Underwriters' knot unnecessary.

Paiste Round, Flush Receptacle.

Strength in the shaft is secured by the heavy brass contact bars which are molded into the cap. A firm grip and good contact are secured by using folded bronze springs in the base. Nibs on these springs catch on recesses in the brass bars of the cap.

A complete line of brass flush receptacles, pipe-taplet receptacles, current taps, chandelier receptacles, porcelain conduit-box and wall receptacles are manufactured to take this attachment plug.

An entirely new fitting is the canopy receptacle, a neat and attractive receptacle which gives an extra outlet at any wall or ceiling fixture which has a canopy.

The construction of a hydroelectric station on the River Mendoza in the Argentine Republic has been approved by the government authorities. It will have an initial capacity of 16,000 horsepower.

Demand for Electric Plants in Many Chinese Cities.

At a recent meeting in Shanghai of the Saturday Club, T. H. U. Aldridge, the Shanghai municipal electrical engineer, made an address which deals with the equipping of Chinese cities, large and small, with electric power and lighting plants, and which may be of live interest to American electric supply houses. Mr. Aldridge tells how the Chinese, especially in the interior, desiring a plant go to work to get it. Within a few years some hundreds of communities will take on electric plants —a score have already done so—and electric equipment houses of a number of nations have elaborate showrooms in Shanghai and other treaty ports, and their agents, who are trained electrical engineers are busy traveling from community to community to secure orders. A printed copy of the address in question will be loaned on application to the Bureau of Foreign and Domestic Commerce, Washington, D. C.

New England Power Operations.

The New England Power Company, which has recently constructed three hydroelectric stations on the Deerfield River in Western Massachusetts, has closed contracts for the supply of energy to the Amherst Power Company, the Fitchburg Gas & Electric Company, the Central Massuchusetts Electric, Marlboro, Gardner and Worcester Electric Light companies, and the Worcester Suburban Electric Company. The company, together with the allied Connecticut River Power and Transmission companies, has installed capacity of about 50,000 horsepower in its several generating plants, and the development of 200,000 horsepower is contemplated. The transmission system is 200 miles in extent, and reaches from Southern Vermont through central Massachusetts to Rhode Island. Power from the generating stations operates

Paiste Plug—Complete.

Paiste Fiber Washer Raised for Wiring.

the newly electrified Hoosac Tunnel supplies, a half dozen towns and supplements local power plants of five street-railway companies. A transmission line has been completed to North Adams, and within a short time the company will supply current for operating the extensive system of the Berkshire Street Railway in western Massuchusetts. A storage reservoir with a capacity of 23 billion gallons, at Somerset, Vt., constructed for the impounding of water to be drawn upon in seasons of drought, is reported to be filling rapidly, one-half of the 100-foot depth of the basin having filled. A new station, near the eastern end of Hoosac Tunnel, will be equipped with generating apparatus, and a second storage basin at Davis Bridge, near the Vermont-Massachusetts line, is projected.

Merger of Electric-Vehicle Manufacturers.

The formation of a $1,500,000 corporation, the American Electric Car Company, to manufacture and market the product heretofore made by three electric vehicle firms, has just been announced. The three firms are the Argo Electric Vehicle Company, of Saginaw, Mich.; the Borland-Grannis Company, of Chicago, and the Broc Electric Vehicle Company of Cleveland.

The three makes of cars will be marketed under their present names by the new company, and the existing agencies probably will be continued. The assets of the three companies are free of incumbrance as taken over by the American Electric, and in addition a large amount of new capital has been acquired. Considerable expansion of the business heretofore carried on by the three firms is announced for the near future.

A great saving in material and manufacturing expenses is predicted for the merger, and an even greater economy in selling cost, as the entire product will be marketed through one organization.

The president of the American Electric Car Company is F. A. Brand; the vice-presidents are Fred Buck, Bruce Borland and U. B. Grannis. Theodore Huss is secretary and treasurer. All of the three original firms are represented on the board of directors.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

BRAKE SOLENOIDS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Solenoids for operating mechanical brakes.

Bulletin Nos. 7710, 7720, 9865.

Approved December 6, 1913.

CUTOUT BASES, Cartridge Fuse.—The Connecticut Electric Manufacturing Company, Connecticut and Florence Avenues, Bridgeport, Conn.

Porcelain-base cutouts for National Electrical Code inclosed fuses, 0-30, 31-60 and 61-100 amperes, 250 and 600 volts.

Approved December 27, 1913.

CUTOUT BASES, Plug Fuse.—George Heinemann & Company, Girard Avenue and Fifth Street, Philadelphia, Pa.

"G. H. Co." porcelain cutout bases for Edison plug fuses; 0-30 amperes, 125 volts; catalog Nos. 1,935, 2,135, 2,165, 2,199, 2,587, 2,965, 8,042.

Approved December 27, 1913.

FIXTURES.—The Dale Company, Ninth Avenue, Thirteenth and Hudson Streets, New York, N. Y.

Dale ceiling one-light fixture, catalog No. 23,735. A metal canopy and shade-holder to which is fastened by two screws a one-piece porcelain receptacle having No. 14 flexible rubber-covered wire leads.

Approved December 27, 1913.

MOLDING FITTINGS.—National Metal Molding Company, Fulton Building, Pittsburgh, Pa.

Fittings for use with "National" metal molding.

Couplings, catalogs Nos. 401a, 402a, 403a, 414, 417a.

Outlet bushings with covers, catalog Nos. 367, 368.

Tees, catalog Nos. 405a, 411a.

Junction boxes, catalog Nos. 363, with cover 363a, 375, with cover 383, 376.

Outlet boxes, catalog Nos. 339, 342R, 343, 363, with cover 363b; 375, with covers 378-381 inclusive; 365, 366.

Straps, catalog No. 425.

Rosettes, fuseless, catalog No. 431.

Approved December 22, 1913.

RECEPTACLES, Standard. — The Bryant Electric Company, Bridgeport, Conn.

"Bryant" porcelain shell.

Keyless, 660 volts, 250 volts.

Sign, catalog No. 4057-Special, when installed so that both the porcelain base and metal rings are held by means of solder so that they cannot turn in the sign face.

Approved December 27, 1913.

ROSETTES, Fuseless.—The Trumbull Electric Manufacturing Company, Plainsville, Conn.

"Circle T," three amperes, 250 volts.

Cleat, catalog No. 758.

Approved December 27, 1913.

SIGNALING SYSTEM. — Electro-Call Signal Company, 1591 Columbus Road, Cleveland, Ohio.

This system is designed for use in supplementing a private telephone exchange, or for signaling persons at a number of places simultaneously from a central point. The system comprises, in its essentials, a sending station, a motor-driven automatic transmitter and a number of gongs mounted in series.

Approved December 27, 1913.

SOCKETS, Weatherproof.—Pass & Seymour, Incorporated, Solvay, N. Y.

"P. & S." mogul base, 1,500 watts, 600 volts, catalog Nos. 243 and 445.

Approved December 27, 1913.

SOCKETS, Weatherproof. — Connecticut Electric Manufacturing Company, Connecticut and Florence Avenues, Bridgeport, Conn.

"C. E. M. Co." 660 watts, 600 volts.

Porcelain, catalog No. 9,366.

Also catalog No. 27 for decorative work when wires are properly soldered to terminals and sealed with an approved insulating compound which does not melt below 200 degress Fahrenheit. Catalog No. 11,001 ready wired for decorative work.

Approved December 27, 1913.

SWITCHES, Fixture.—The Bryant Electric Company, Bridgeport, Conn.

Chandelier Switches.

"New Wrinkle" pull switches, three amperes, 125 volts; one ampere, 250 volts; catalog Nos. 406, 406-Special.

Approved December 27, 1913.

TRANSFORMERS.—Fort Wayne Electric Works of General Electric Company, Fort Wayne, Ind.

Bell-ringing transformers, designed for connection to 110-volt alternating-current circuits:

Catalog No. 97,207; secondary, 4, 8 and 12 volts.

Catalog No. 97,299; secondary, 10 volts.

"Wayne;" secondary, 12 volts.

Approved December 18, 1913.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

KINGSTON, OKLA.—This place has granted a franchise for an electric-lighting system.

PULASKI, TENN.—$15,000 will be expended to complete the lighting plant. Address the city clerk.

BUDA, ILL.—The Council is planning ways and means to secure electric lighting. Address the city clerk.

ROCK ISLAND, ILL.—The Council is planning to secure additional street lights. Address the city clerk.

PECOS, TEX.—The City Council has decided to erect a system of ornamental lights in the business district. D.

ASHLAND, ILL.—The Council is planning ways and means to secure electric lighting. Address the city clerk.

RUNGE, TEX.—$25,000 will be expended for a light and water system. Address the mayor for information.

HAZELTON, PA. — The Council is planning to erect municipal electric light plant here. Address the city clerk.

STEWARTVILLE, MINN.—A movement has started for issuing bonds for $15,000 for the electric light plant. C.

RICHLAND, MO. — The construction of a municipal light plant will be considered at once. Address the city clerk.

HUNTINGTON BEACH, CAL. — The Pacific Light & Power Company has been granted a 40-year franchise in this city.

WINFRED, S. D.—The Council is planning to establish a municipal lighting plant. Address the city clerk for particulars.

HYATTSVILLE, MD.—$10,000 will be expended installing an electric light plant here. Address the city clerk for particulars.

DECATUR, NEB.—Electric light bonds have been voted, plans and specifications have been prepared and contracts will soon be let. C.

WINCHESTER, ILL.—A company has been organized to build an independent electric plant. Address F. H. Allen, for information.

PLEASANTON, TEX.—The Pleasanton Ice & Light Company, is planning to install equipment and improve the light and power plant.

CLEVELAND, O.—The Konery Electric Company has been incorporated with a capital stock of $10,000 by C. F. Schultz, and others.

WAUKEGAN, ILL.—Estimates are being received for installing ornamental lighting. Address Mayor Bidinger for further particulars.

ESBON, KANS.—The Council is planning ways and means to install a municipal lighting plant. Address the city clerk for particulars.

RED LAKE FALLS, MINN.—E. F. Wheeler is preparing plans and securing data as to cost of construction for a "White Way" lighting system. C.

DUVALL, WASH.—Duvall Light & Power Company has been incorporated with a capital stock of $16,000 by E. Milton and Stephens B. F. Bird.

CALEXICO, CAL.—Plans are under way for the city to operate its own electric light plant for street lighting in conjunction with its water system.

NEEPAW, MAN.—A bylaw authorizing the expenditure of $18,000 on a municipal electric light and power plant was voted on and passed. C.

HALLS, TENN.—The city will improve the electric light and water plant. Electrical equipment will be installed. Address B. M. Archer for further facts.

INDIANAPOLIS, IND.—The Park Board plans to light the boulevards with electricity. Address James H. Lowey, secretary of board for desired information.

FORDVILLE, N. D.—This village is planning the installation of a combined electric light and fire-protection system. Address the secretary of the Commercial Club.

PORTLAND, ORE.—Garibaldo Power Company has been incorporated with a capital of $15,000. The incorporators are: Charles J. Schnabel, Newton C. Smith and J. B. Ofner.

MINNEAPOLIS, MINN.—Architects Long, Lamoreaux and Long, 830 Hennepin avenue, are preparing plans for a 14-story hotel, the specifications including an electric plant.

ROCK FALLS, ILL.—$8,000 in bonds has been voted for improving and extending the municipal electric-light system. Address O. M. Aarvig, superintendent.

SHERMAN, TEX.—An election will be held to decide the question of issuing $5,000 in bonds for street lighting. Address Joseph P. Cox, city attorney, in regard to this project.

OTTUMWA, IOWA.—The Ottumwa Railway & Light Company, is considering the building of a transmission line to Bloomfield to provide electric light and power service for that city.

SAN ANTONIO, TEX.—J. D. Sug, owner of the San Angelo street railway system, is planning to extend the car lines here and to erect a power plant. He also promises the opening of a park.

SYDNEY, N. S., CAN.—Electric Lights are to be installed at Westmount, a suburb of Sydney across the harbor. Details can be obtained from John Midgley, McVey Block, Sydney, Nova Scotia.

SYRACUSE, N. Y.—The Mayor and City Council have passed an ordinance providing for the installation of 378 additional lamps in the ornamental lighting district. Address Henry C. Allen, city engineer.

LOS ANGELES, CAL.—The Board of Supervisors of Los Angles County will receive sealed bids up to February 2 for installing and operating a street lighting system in the Idylwild lighting district.

YOUNGSTOWN, O.—Mayor F. A. Hartenstein states that the Council of this city is now seriously considering a municipal lighting system and that at the proper time he will make some recommendations on this subject. R.

RAVENNA, MICH.—Business men here are considering the organization of a company to develop water supply in Crockery Creek, a stream from which it is figured 30 horsepower can be secured. Address J. E. Kline, for desired information.

ST. CLOUD, MINN.—The Power Distribution Company has settled its financial difficulties and construction will go forward. Power will be generated here with auxiliary stations at Howard Lake and Eden Valley. W. Baer Ewing, Minneapolis, is president. C.

DASSEL, MINN.—W. R. Rutledge, Howard Lake and Ernest Johnson, of this city, have formed an electrical construction company, with headquarters here, and will have charge of all wiring and building service lines for the Power Distribution Company. C.

MADISON, IND. — The Madison Light & Railway Company has asked the permission of the State Public Service Commission to issue $25,000 of mortgage bonds to be used for adding to the capacity of its power plant and extending its lighting service to Hanover, Ind. G.

LYONS, N. Y.—L. C. Reynolds, general superintendent of the Central Gas & Electric Company, is at work upon a set of plans for improving and enlarging the power house in this village, which when completed will enable the company to double the amount of power now generated here.

LA CROSSE, WIS.—The Railroad Commission has ordered the Neshonic Light & Power Company to furnish to the Commission complete plans and specifications for a hydroelectric power plant to be built on the site of the present plant. When the plans are approved it is required that the plant shall be built and completed within six months.

VANCOUVER, B. C.—The Western Canada Power Company, with offices in Vancouver, intends to add two 13,000-horepower hydroelectric generating units to its present plant. One of the new turbines will be installed next spring and the other early in 1915. The present plant of the company, consisting of two units, is capable of generating more than 25,000 horsepower. The additional plant and equipment of the new unit, including installation, will involve an expenditure of $500,000.

CENTRAL CITY, KY.—Dr. W. H. Netherland, a well-known banker of Louisville, is one of those interested in the construction of a large power plant and a traction system in the Western

Kentucky coal fields, with the principal work in this city. Dr. Netherland states that full details of the project, which involves an ultimate expenditure of $3,000,000, will be given out in the near future. G.

ZANESVILLE, O.—A plan which is intended to solve the light and power problem of this city has been offered by the Civic Government Association and will probably be presented to the Council. It recommends the purchase of the Hook Brothers and Aston Mill and that firm's water power rights, and proposes to utilize the property for the erection of a municipal power plant, contemplating the generating of sufficient electricity to light and furnish power to the city for the operation of the pumps at the water works station. R.

WOODLAND, CAL. — The State Water Commission has decided that the Yolo Water & Power Company is entitled to the use of the surplus water of Clear Lake, which will be employed to develop electric power to be distributed throughout Central California and for the irrigation of more than 150,000 acres in Yolo County. It is announced that the company has already expended $1,500,000 in construction of a dam and acquisition of water rights, and that $7,000,000 will be spent to perfect the system and erect two power houses with a combined capacity of 50,000 horsepower. It is proposed to offer electric service to San Francisco and other bay cities within the next five years.

URICHSVILLE, O.—Manager Stilgenbauer, of the County Electric Company, states that the details of the merger of the Twin City Traction Company, the Midland Power & Traction Company of Cambridge, the Coshocton Light & Heat Company and the LaFayette Light & Power Company has been completed and one of the results will be an immediate improvement in the light and power for consumers here and in Dennison. He states that the Ohio Service Company will begin the construction in the spring of a transmission line from Coshocton to this city and Dennison, so that electricity both for light and power may be obtained from the plant here as well as from the plant at New Philadelphia. R.

STATESVILLE, N. C.—The Southern Power Company may not be alone in the development of additional waterpower on the Catawba River in the proximity of Statesville. It is learned that plans are now being considered by the Long Island Cotton Mills, which, should they materialize, will mean the erection of a mammoth power plant on the Iredell side of the River. In addition to its Long Island property the mill company owns valuable undeveloped waterpower at Buffalo Shoals, just above Long Island, which combined with Long Island power would be capable, according to engineers, of developing from 1,500 to 2,000 horsepower. Three years ago, the Long Island company acquired water rights on the Iredell side of the River opposite its present dam, and it now has options on sufficient property for a large power and mill plant. These valuable options also include the rights of way for a power line. Other parties who own undeveloped power at Buffalo Shoals, include Statesville people, are considering a proposition to join with the Long Island company in the erection of a mammoth concrete dam at Long Island 15 to 18 feet in height.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

SPOONER, MINN.—A co-operative telephone line will be built along the state road to Loman. V. E. Lindholm is interested. C.

HUNTLEY, MONT.—The Farmers Telephone Company has set poles for a line to Worden and will make connection with the Ballantine line. C.

GRAVE LAKE, MINN.—The Grave Lake Telephone Company has been organized by farmers in this vicinity and will build a line into Brainerd. C.

MACEDONIA, ILL.—Macedonia Telelphone Company has been incorporated with a capital of $2,500 by H. C. Vise, J. M. Lee, and Lewis W. Fisher. C.

NEW BRUNSWICK, N. J.—The New York Telephone Company has been granted permission to extend its system in Woodbridge and Piscataway Townships. A.

NASEL, WASH.—Nasel Farmers' Telephone Company has been incorporated with a capital of $1,000 by F. G. W. O'Conner, B. W. Higgins, and N. A. Johnson.

NARY, MINN.—The Malvig Rural Telephone Company will construct a line from Nary to Bemidji, work to commence in the spring. J. O. Smustad is president.

HARRISBURG, PA.—Plans for the construction of the underground fire-alarm cables have been prepared and are now in the hands of City Electrician Clarke E. Diehl.

FRUITVALE, CAL.—The Pacific Telephone & Telegraph Company will erect a three-story telephone building here and apparatus necessary to operate the switchboard will be installed.

VIRGINIA, MINN.—Engineers of the Mesaba Telephone Company are preparing estimates of cost of a new building here, to be modern throughout. Mr. Holcomb is local manager. C.

MORRISVILLE, N. J.—The installation of a new fire-alarm system is being considered by the Borough Council. The Fire Protection Committee is in charge of the improvement. A.

TYRONE, IOWA.—A line is being built from here to Staceyville to connect with lines of the Iowa Telephone Company, and an exchange will be operated at Tyrone. C.

KENYON, MINN.—Dr. J. A. Gates, owner of the telephone exchange, together with the Northwestern Telephone Company, is making plans for rebuilding all the lines here, work to begin in spring. C.

GRASS RANGE, MONT.—Preliminary steps have been taken for construction of a telephone line between here and Minnesota Beach. Dr. P. H. Brown is interested. Other branches will be built this year. C.

CHEYENNE, OKLA.—The Board of Trustees of Cheyenne has called a special election for February 16 on the question of granting a franchise for 25 years to the Roger Mills Telephone Company to operate a telephone system in the town. P.

ROCK ISLAND, ILL.—Members of the Commission have been handed by Commissioner Hart tentative plans for the installation of a complete police-call system for this city. Bonds to the extent of $10,000 for this purpose have been voted. Address Mayor H. M. Schriver.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SYDNEY, N. D.—The Cape Breton Electric Railway Company is planning the extension of its line from Sydney to New Waterford. Address Earl L. Millikan, local manager.

PADUCAH, KY. — The Kentucky Southwestern Electric Railway Light & Power Company is planning to construct an interurban railroad here. Address H. C. Rhodes, president, for particulars.

OSWEGO, ORE. — The Portland Eugene & Eastern Railway Company has been granted a franchise to construct and operate an electric railway here. Address E. A. Hutchinson, of Portland, for information.

CLARKSTON, WASH.—The Committee recently appointed to solicit subscriptions for the Sturm Electric Railway report that $6,200 of the desired $10,000 has been secured for the project. O.

TEMPLE, TEX.—Preliminary surveys are being made by County Surveyor S. D. Hanna, of Bell County, for the proposed Temple-Marlin interurban line, 30 miles in length. The project is being backed by Temple capitalists. D.

CLEVELAND, O. — The Cleveland Railway Company has submitted to Traction Commissioner Witt a request to relay 12 miles of track this year, at a cost of $682,000. Address the general manager of the Cleveland Railway Company.

BOWLING GREEN, KY.—J. S. Lewis, who recently purchased the street railway system of this town at a receiver's sale, has taken charge of the property and is planning a number of improvements, as well as various extensions. G.

SANDY, ORE. — A company of prominent business men has been formed for the purpose of constructing an interurban line from this city to Boring, seven miles distant. The matter has been presented to the Clackamas County Court. O.

BEACH, N. D.—Plans have materialized which will result in the construction of the first electric railway in the state to be financed and operated by farmers. The line will run from Baker, Mont., through Dennis, N. D., Carlyle, Alpha, Williams to Beach. The proposition is meeting with enthusiastic endorsement throughout the entire community.

POCATELLO, IDAHO. — J. D. Browning and associates recently made application to the City Council for the construction, maintenance and operation of an electric street railroad in this city. Under its terms, the company proposes to construct at least one mile of electric line the first year, another mile the second year, and three miles the third year. Fifty years is the life of the franchise. O.

LAWTON, OKLA.—The Lawton Railway & Light Company has asked the City Commissioners of Lawton to call an election on the proposition of granting it a street-railway franchise. The company asking the franchise now holds a lighting franchise for Lawton and is understood to be prepared to purchase the holdings of the old company, which owns the now unused tracks. If the deal goes through the line will be extended to Fort Sill.

NEW INCORPORATIONS.

DETROIT, MICH.—Detroit Battery Company has been incorporated with a capital stock of $10,000 to deal in electric batteries.

NEW YORK, N. Y.—Curtis & Carhart Electric Appliance Company has been incorporated with a capital stock of $10,000 by W. F. Curtis, Percy Murlet and B. I. Carhart.

CANTON, O.—The Lincoln Electric Manufacturing Company has been incorporated with a capital stock of $50,000 by William Rossiter, Al Schram, C. C. Howe and others.

LOGAN, W. VA.—Guyan Machine Shops have been incorporated to manufacture machinery and electrical apparatus. The capital stock is $25,000 and the incorporators are W. E. Oliver, Jr., Bernard Shell, J. J. Rose, A. C. McConoghey, W. T. Woolcock.

CHICAGO, ILL.—Royal Electric Heater Company has been incorporated with a capital of $10,000 to deal in electrical heaters, appliances, automobile accessories. William V. Brothers, David M. Brothers and George A. McCarkle are the incorporators.

MANHATTAN, N. Y.—A. & T. Storage Battery Company, Incorporated, has been incorporated with a capital stock of $1,000,000 to manufacture and deal in storage batteries, generators, dynamos for heat, light, power, etc. The incorporators are J. Splitdorf, D. B. Nally and A. L. Kuii, all of New York City.

CLEVELAND, OHIO.—The Industrial Electric Company has been incorporated by men connected with the Samuel Austin & Son Company, construction engineers. The company will handle electrical equipment for installation in factories and buildings as designed by the Austin offices.

WILMINGTON, DEL.—International Engineering & Development Company has been incorporated with a capital stock of $200,000 to engage in the business of mechanical, mining, civil and electrical engineering. The incorporators are W. L. Maloney and N. P. Coffin, of this city. of incorporation have been filed here for the California Electric Supply Company with a capital stock of $25,000 by J. Hepburn, J. F. Walters and H. Hepburn.

WILMINGTON, N. C.—A certificate of incorporation for the Belfast Land Company, of this city has been filed. Messrs. Samuel R. Maxwell, William B. Herring and C. F. Davis are given as the incorporators. It is set forth that the company is to own, develop and deal in real estate, both as principal and agent, to negotiate loans, issue bonds, etc., to build, construct and repair bridges, wharves, piers, hotels, water, gas and electric works and to own and sell such utilities. The total authorized capital stock is $100,000.

MONTREAL, QUEBEC. — Letters patent incorporating the Northern Electric Company, Ltd., with a capital stock of $10,000,000 have been issued by the Secretary of State. The company is empowered to manufacture every kind of electrical machinery, to carry on the business of mechanical and electrical engineers, to mine, smelter, refine and deal in ores, metals, ingots, billets and other products of ores, acquire title to telephone, telegraph, light, heat, power and hydraulic plants, and to amalgamate with any other company or individual engaged in the same or similar lines of business.

PROPOSALS.

STORAGE BATTERY.—Bids will be received by W. H. Harrison, city clerk, Great Falls, Mont., until February 2 for furnishing and installing a storage battery with all accessories for a fire-alarm system. Check for two per cent must accompany bids. C.

COPPER AND TROLLEY WIRE.—February 2 bids will be received, for furnishing and delivering to the city of Chicago at its water works shops, 2304 South Ashland Avenue, eight tons of ingot copper and seven tons of old copper trolley wire. Address L. E. McGann, Commissioner of Public Works, Chicago.

ELECTRIC CONDUIT, WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until February 11, for a conduit and wiring system for the post office at Bay City, Mich.; until February 28 for the electric conduit, wiring and interior lighting fixtures of a two-story building for the post office at Big Rapids, Mich.; and for a one-story building for the post office at Searcy Ark.; and until March 9 of a two-story building for the post office at Williston, N. D., as per drawings and specifications, copies of which may be obtained from the office of the Supervising Architect or the custodians of the sites named.

ELECTRICAL FITTINGS. — Bids will be received at the office of Sanitary District, Room 700, 900 South Michigan Avenue, Chicago, Ill., for Division A: 4.1-ampere 60-cycle oil-immersed manhole-type impedance coils. Division B: tubular steel poles. Division C: malleable iron cross arms. Division D: porcelain line insulators. Division E: circuit-break insulators. Division F: round-pattern manhole frame covers. Division G: underground conduit. Division H: paper-insulated eight-conductor lead-covered cable. Division J: single-conductor armored cable. Division K: multiple-conductor 12,000-volt varnished-cloth insulated lead-covered cable. Division L: weatherproof wire. Division M: combination pole, doors and pulleys. Division N: arc-lamp counterweights. Division O: cast-iron postheads with series receptacles and equipment. Address Thomas A. Smyth, president of the Board of Trustees. Bids close on February 5.

ELECTRICAL EQUIPMENT. — Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing the following for delivery at Navy Yards named, until February 17 for furnishing one electrically heated oil-tempering bath, Schedule 6321, Boston, Mass.; seven electrically operated ice-cream freezers, Schedule 6319, Brooklyn, N. Y.; until February 24 for one electrically operated meat and food chopper, Schedule 6325. Puget Sound, Wash.; six electrically operated air compressors, complete, f. o. b. works, Schedule 6338; 2,000 duct feet of four-way terra-cotta conduit, Schedule 6334, Key West, Fla.; 44 converting turbogenerating sets from five to ten kilowatts, f. o. b. works, Schedule 6339; miscellaneous electrical equipment, Schedule 6336, Newport News, Va., and Brooklyn, N. Y.; one electric traveling monorail hoist, 1.5 tons lifting capacity, Schedule 6329, Washington, D. C.; and one electrically operated dough-mixing machine, Schedule 6325, Puget Sound, Wash.

NEW PUBLICATIONS.

MINERAL RESOURCES. — The United States Geological Survey has published Part 2 of the "Mineral Resources of the United States" for the year ending 1912. It deals with the nonmetals.

TELEPHONE PROBLEMS.—The address delivered by Alonzo Burt before the Ways and Means Committee of the Chicago Association of Commerce, on November 26, 1913, entitled "Some of the Problems of the Telephone Business," has been printed in pamphlet form.

SOUTH HADLEY REPORT.—The report made by the special committee appointed to investigate the question of municipal lighting for the town of South Hadley, Mass., has been published in pamphlet form. It consists principally of the report made to the committee by William Plattner, consulting engineer. The report favors municipal ownership and operation.

WAVE-FORM ANALYSIS.—Technical Paper No. 203 of the Bureau of Standards, Washington, D. C., is entitled "Analysis of Alternating-Current Waves by the Method of Fourier With Special Reference to Methods of Facilitating Computations." by Frederick W. Grover. It includes derivation of the necessary equations, formulas and short-cuts for computation, and examples of application.

PHILADELPHIA ELECTRICAL REPORT.—The annual report of the Chief of the Electrical Bureau of Philadelphia, Pa., for the year 1912 has been issued in the form of a printed pamphlet by Clayton W. Pike, chief. This department has charge of public lighting, the police and fire alarm signals, the municipal telephone system, electrical equipment in the City Hall, and inspection of electrical work outdoors and in the city buildings.

ELECTROLYSIS MITIGATION.—Technologic Paper No. 27, issued by the Bureau of Standards, Washington, D. C., is entitled "Special Studies in Electrolysis Mitigation," by E. B. Rosa and Burton McCullum. This deals particularly with the conditions in Springfield, O., and the recommendations made for improving the conditions there. The principal recommendation is the use by the electric street railway of insulated negative-return feeders and electrical connections at all crossings of different systems. The investment required for this purpose is warranted by the saving in power.

COAL WASHING.—"Coal Washing in Illinois," by F. C. Lincoln of the Department of Mining Engineering, has just been issued as Bulletin No. 69 by the Engineering Experiment Station of the University of Illinois. A great amount of data, gathered from experiments made in the Mining Laboratory of the University, personal visits to the various coal washeries in the State, and a thorough search of the scattered literature on the subject, have been compiled and tabulated in this Bulletin. The Bulletin also contains an article by S. W. Parr, which considers "Moisture in Washed Coals," and is a summary of tests made at the Experiment Station on carload lots of various washed coals. Copies of Bulletin No. 69 may be obtained upon application to C. R. Richards, acting dean, University of Illinois, Urbana, Ill.

FINANCIAL NOTES.

The Puget Sound Traction, Light & Power Company has sold to Lee, Higginson & Company and Harris, Forbes & Company $7,000,000 five-year six-per-cent mortgage bonds.

At the annual meeting of the Washington Railway & Electric Company former officers and directors were re-elected. At the annual meeting of the subsidiaries of Washington Railway & Electric former officers and directors were re-elected.

Lee, Higginson & Company, Harris, Forbes & Company and Kissel, Kinnicutt & Company, New York syndicate managers, announce that the $30,000,000 Interborough Rapid Transit Company first- and refunding mortgage five-per-cent bonds purchased by them have all been sold and the syndicate is closed.

Harris, Forbes & Company have purchased $222,000 first-lien and refunding five-per-cent gold bonds from the Consumers' Power Company. The company will spend this amount the current year in additions and betterments.

In the six months ended December 31 the Interborough Rapid Transit Company's surplus for dividends was $3,272,574, equal to 9.3 per cent on the company's $35,000,000 capital stock. The dividend surplus showed an increase of $445,602 over the corresponding period last year.

The Tampa Electric Company is offering subscription rights to stockholders, for the $374,000 of stock recently authorized, at par in the ratio of one share of the new stock for each six shares now held. Subscription rights accrue to stock of record January 17 and subscriptions are payable on or before February 25. With this issue of stock the capitalization of Tampa Electric will be $2,618,000.

All electric properties operated by H. M. Byllesby & Company reporting for the week ended January 10, show a net gain in connected electric load of 227 consumers with 190 kilowatts of lighting capacity. New business contracted for but not connected for the week aggregated 787 customers with 767 kilowatts of lightning and 455 horsepower in motors. The output of the properties for the week was 7,081,848 kilowatt-hours, a gain of 6.8 per cent over the corresponding week of 1913.

A merger of electrical properties in Newport News and Hampton, under the name of the Newport News & Hampton Railway, Gas & Electric Company, with a capital stock of $2,500,000, has been authorized by the Virginia Corporation Commission. It will include what were formerly the Citizens' Railway, Light & Power Company, the Hampton Roads Traction Company and the Newport News & Old Point Railway & Electric Company. The present operating officials will continue in charge of the property.

Dividends.

American District Telegraph Company of New Jersey; regular quarterly dividend of one per cent, payable January 29 to stock of record January 17.

American Railways Company; the regular quarterly dividend of 1.75 per cent on the preferred stock, payable February 14, to stock of record January 31.

Binghamton Railway Company; a dividend of two per cent, payable February 28 to stock of record February 14.

Bristol Tramway Company; regular semi-annual of three per cent, payable February 2 to stock of record January 28.

Cities Service Company; regular monthly of 0.5 per cent on preferred and common, payable March 1 to stock of record February 15.

Galveston-Houston Electric Company; a semi-annual common dividend of $3.50 per share, payable March 16 to stock of record March 5.

Harrisburg Traction Company; a dividend of three per cent, payable February 1.

Illinois Traction Company; regular quarterly of 0.75 per cent on common, payable February 15 to stock of record January 31.

International Traction Company; supplementary of two per cent on account of accumulated back dividends on preferred, payable February 2.

Kellogg Switchboard & Supply Company; stock dividend of 25 per cent and quarterly of three per cent, payable February 3. The stock dividend is payable January 26.

Monongahela Valley Traction Company; semi-annual of 2.5 per cent on preferred, payable February 1 to stock of record January 27.

Sierra-Pacific Electric Company; the regular quarterly dividend of $1.50 a share on its preferred stock, payable February 2, to stock of record of January 22.

Southern California Edison Company; quarterly of $1.50 on common, payable February 15 to stock of record January 31.

Reports of Earnings.

DAYTON POWER & LIGHT COMPANY.

Preliminary report of the Dayton Power & Light Co., for the year ended December 31, 1913, shows:

	1913.	1912.
Gross earnings	$ 734,900	$ 681,440
Operating expenses	447,750	357,715
Net earnings	287,150	323,725
Other income	18,000	27,060
Total income	305,150	350,785
Fixed charges	202,750	190,890
Balance	102,400	159,895
Preferred dividend	92,250	85,500
Surplus	10,150	74,395

CHATTANOOGA RAILWAY & LIGHT.

November gross	$ 97,032	$ 91,293
Net after taxes	37,608	35,931
Surplus after charges	11,536	13,253
Twelve months' gross	1,200,004	1,053,047
Net after taxes	486,067	425,282
Surplus after charges	190,137	162,187
Balance after preferred dividends	90,137	62,187

CUMBERLAND COUNTY POWER & LIGHT.

November gross	$ 195,100	$ 176,866
Net after taxes	84,470	78,798
Surplus after charges	20,894	22,288
Twelve months' gross	2,324,384	2,123,117
Net after taxes	1,025,562	897,242
Surplus after charges	318,355	259,311
Balance after preferred dividends*	188,355	184,311

*Equivalent to 7 per cent on common stock.

CONSUMERS POWER OF MICHIGAN.

November gross	$ 291,035	$ 263,903
Net after taxes	155,483	143,185
Surplus after charges	84,655	88,140
Twelve months' gross	3,114,297	2,730,280
Net after taxes	1,451,623	1,277,693
Surplus after charges	697,228	653,984
Balance after preferred dividends	383,728	387,734

AUTOMATIC ELECTRIC, CHICAGO.

The Automatic Electric Co. (Chicago), has issued its annual report for the year ended December 31, 1913. The income account compares as follows:

	1913.	1912.
Gross income	$ 903,382	$ 855,999
Net profits	478,009	596,731
Surplus for year	293,641	298,025

BELL TELEPHONE SYSTEM.

The report of the American Telephone & Telegraph Company and associated holding and operating companies in the United States, not including connected independent or sub-licensed companies, for eleven months ended November 30, 1913, was issued yesterday. It shows the following results from operations:

	1913.	1912.
Gross earnings	$197,452,138	$181,411,083
Net	$ 53,858,152	$ 52,811,083
Deductions	15,203,199	12,854,833
Balance	$ 38,654,953	$ 39,956,647
Dividends	27,773,640	26,958,413
Surplus	$ 10,881,313	$ 12,998,234

WESTERN UNION TELEGRAPH.

The Western Union Telegraph Company has issued its estimated statement of earnings for the quarter ended Dec. 31, 1913, which compares with the same period of 1912 as follows:

	1913.	1912.
Gross income	$11,932,200	$11,835,000
*Expenses	10,824,820	10,713,300
Net revenue	1,107,380	1,121,700
Bond interest	334,307	334,310
Balance	773,073	787,390
Dividends	748,073	748,040
Surplus	25,000	39,350

*Includes rent of leased lines, current maintenance, depreciation and taxes.

The company has also issued a more detailed statement covering the eleven months ended Nov. 30, which compares as follows:

	1913.	1912.
Gross earnings	$41,985,832	$40,390,221
Operating expenses, including rent of leased lines	31,191,512	29,637,409
Maintenance	3,440,227	3,386,569
Depreciation and reconstruction	3,126,283	3,259,283
Taxes	1,057,500	853,414
Total expenses	38,815,523	37,136,674
Balance	3,170,309	3,253,546
Other income	918,035	984,391
Total income	4,088,344	4,237,938
Interest	1,225,793	1,359,105
Surplus	2,862,551	2,878,832
Dividends	2,742,889	2,742,698
Surplus	119,662	136,135

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Jan. 26.	Jan. 19.
American Tel. & Tel. (New York)	123½	120¼
Commonwealth Edison (Chicago)	133½	134
Edison Electric Illuminating (Boston)	257½	251½
Electric Storage Battery common (Philadelphia)	50	49½
Electric Storage Battery preferred (Philadelphia)	50	49½
General Electric (New York)	147¼	144
Kings County Electric (New York)	120	119
Manhattan Transit (New York)	1	1⅛
Massachusetts Electric common (Boston)	14	12½
Massachusetts Electric preferred (Boston)	65¾	64½
National Carbon common (Chicago)	155	135
National Carbon preferred (Chicago)	116¾	119
New England Telephone (Boston)	139½	134
Philadelphia Electric (Philadelphia)	26⅜	26⅜
Postal Telegraph and Cables common (New York)	82	78½
Postal Telegraph and Cables preferred (New York)	67½	66½
Western Union (New York)	63¾	59
Westinghouse common (New York)	70¾	67⅝
Westinghouse preferred (New York)	116½	115¼

PERSONAL MENTION.

DR. ERNEST RUTHERFORD, Langworthy professor of physics in the University of Manchester, has been made a knight.

MR. EDWIN N. SANDERSON, of Sanderson & Porter, engineers and contractors, has been elected president of the Federal Light & Traction Company, New York.

MR. CHARLES WIRT, president of Wirt Company, Philadelphia, will sail on the *Berlin* today for Naples. He will be absent for about two months on business connected with European sales.

MR. FRANK L. PERRY, Baltimore, Md., delivered an illustrated lecture on "Curious Things Electrical," at the Hotel Belvidere, Baltimore, Md., before the Accountants' Club on Thursday evening, January 15.

MR. H. B. WILLIFORD, electrical inspector of the Oklahoma Inspection Bureau, will take the position of chief electrical inspector on February 1, of the Arkansas Actuarial Bureau at Little Rock, Ark.

MR. H. H. ROBERTSON, president of the Asbestos Protected Metal Company, of Beaver Falls, Pa., has been elected vice-president of the Pittsburgh Branch of the National Council for Industrial Safety.

MR. R. H. HARPER has been appointed sales manager of the Barnes & Kobert Manufacturing Company, manufacturers of pole line hardware and pressed-steel construction specialties, New Haven, Conn. Mr. Harper was for several years sales department manager with the Western Electric Company, at New York.

MR. JOHN S. KENNEDY, formerly secretary of the New York Public Service Commission for the Second District, has been made secretary of the Employees' Benefit Fund Committee of the associated Bell companies, including the New York Telephone Company, the Bell Telephone Company of Pennsylvania and the Chesapeake & Potomac Telephone Company.

MR. WILLIAM H. GRAY, hitherto sales manager of Gray and Davis, Incorporated, Boston, manufacturers of electric starting and lighting apparatus for automobiles, has become general manager of that company. Besides having general supervision of the organization, Mr. Gray will still be in close touch with the selling department and will direct its policy.

MR. E. C. BATES has resigned as district manager of the Bell Telephone Company at Pittsburgh, Pa., after a continuous service of 10 years. He becomes secretary of the Pittsburgh Athletic Association. During his service for the telephone company Mr. Bates was special agent, local manager, contract agent, and lastly filling the position from which he has just resigned.

MR. C. A. TUPPER, for many years publicity manager and confidential representative of the Allis-Chalmers Manufacturing Company, and more recently secretary-treasurer of the Penton Publishing Company of Cleveland, O., has returned to the west and is now connected with the Mining World Company, publishers of the *Mining World*. Mr. Tupper has been elected secretary-treasurer of the company, and will devote most of his time to this business from February 1.

MR. ROBERT MONTGOMERY, for the past three years new business manager of the Fort Worth (Tex.) Power & Light Company, will on February 1 assume the position of commercial manager of the Louisville Gas & Electric Company. Before going to Fort Worth, Mr. Montgomery was with the Chicago,

Robert Montgomery.

Lake Shore & South Bend Railway, engaged in commercial work, and previous to that was for five years connected with the Cincinnati office of the General Electric Company. During the past two years of Mr. Montgomery's connection with the Fort Worth Power & Light Company, its power load has been more than doubled.

MR. McKEW PARR has been appointed general sales manager of the Hart & Hegeman Manufacturing Company. "McKew" is one of the most popular, enterprising and energetic young men in the electrical field, and a host of friends and acquaintances will congratulate him upon his appointment and wish for him a dis-

McKew Parr.

tinguished success. He is a native of Baltimore, and became associated with the Hart & Hegeman Manufacturing Company as its Southern representative in 1909. He was graduated in the class of 1906 at the United States Military Academy at West Point. Before entering the electrical field he was connected with the Baltimore *Herald* and the Merchants National Bank of Baltimore. He then became connected with the Maryland Telephone Company, of Baltimore, and later with the Cataract Electrical Supply Company of Buffalo. He represented the Hart & Hegeman Company in its Southern territory for two years and was then appointed advertising manager, continuing in that capacity until his recent promotion. He is a member of the Baltimore Club, of the Maryland Society of the Sons of the American Revolution and a Statesman of the Jovian Order.

MR. G. WILBUR HUBLEY, chief engineer of the Louisville (Ky.) Gas & Electric Company, and MR. LOUIS S. STRONG, assistant engineer of the same company, have been elected directors of the Louisville Engineers' and Architects' Club. MR. FRANK H. MILLER, superintendent of motive power of the Louisville Railway Company, is also a director, as the result of the recent annual election.

MR. L. N. WHITNEY, general manager of the Central Union Telephone Company of Indiana, has been appointed general commercial superintendent of the New England Telephone & Telegraph Company, Boston, in place of Carl T. Keller, resigned. He will take up his duties in New England on February 1. Mr. Whitney is a native of Council Bluffs, Iowa, and is 41 years of age. Most of his early life was spent in the neighborhood of Boston and he was educated at Massachusetts Institute of Technology. Immediately after graduating, in 1896, he entered the service of the American Telephone & Telegraph Company at New York.

MR. A. J. SHORT, manager of the electric light plant of the Kentucky Public Service Company at Frankfort, Ky., has been appointed superintendent of the plant, MR. H. C. MOORE, formerly with the auditor's office of the company at Bowling Green, Ky., being given the position of manager in charge of the commercial end of the business. MR. EDWIN L. SELLERS, of Bowling Green, has been appointed manager of the new business department of the whole company, which operates plants in four Kentucky and one Tennessee city. MR. R. A. FIELD, formerly general manager of the company, has retired, MR. H. D. FITCH, as heretofore announced, succeeding to the position.

MR. WILBUR B. FOSHAY has opened offices in the Wilcox Building, Portland, Ore., where he will do general consulting engineering in addition to overseeing his interests in the Washington Public Service Company, of Olympia, Wash. Mr. Foshay has severed his connection with the Northwestern Electric Company, of Portland. He was manager of the company from October, 1912, until January 1 of the present year. Before going with the Northwestern Electric Company Mr. Foshay was for about two years district manager of the Washington-Oregon Corporation, operating plants in Oregon and Washington. Prior to this he was with the Pacific Power & Light Company, as manager, at Walla Walla, Wash. His earlier connection was with the Fort Dodge Light & Power Company, as general manager at Fort Dodge, Iowa, going there from Hutchison, Kans. Mr. Foshay has operated plants of every type of known prime mover and has been connected with operating hydroelectric plants, water works and gas and street-railway properties.

MR. SHIRAS MORRIS, secretary and treasurer of the Hart & Hegeman Manufacturing Company, Hartford, Conn., for several years, was elected president and treasurer of the company at the annual meeting last week, succeeding the late MR. ALFRED H. PEASE, who died on Thanksgiving Day. Mr. Morris was graduated from Trinity College in 1896. In that year he entered the cost department of the Pope Manufacturing Company, a year later being promoted to the position of assistant advertising manager. After a year as advertising agent for the Pope Company he became associated with the Hart & Hegeman Manufacturing Company. Two years later he was elected secretary of the company, and two years thereafter, when he was re-elected secretary, the duties of treasurer were also voted to him. His promotion to the post of president is a recognition upon the part of the stockholders of his ability not only in the financial department of the company, but as an organizer and executive as well. Mr. Morris is secretary and treasurer of the Kinsler-Bennett Company, vice-president of the Hartford Chapter of the National Association of Credit Men, treasurer of the Manufacturers' Association of Connecticut, and a member of the directorates of the American Industrial Bank & Trust Company, Industrial Realty & Title Guarantee Company, New England Sherardizing Company, New Haven Sherardizing Company and the Hartford Young Men's Christian Association. He is a member of the board of fellows of Trinity College, Hartford Board of Trade, Hartford Business Men's Association, Hartford Club, University Club, Hartford Golf Club, Republican Club of Hartford, and the Jovian Order.

Shiras Morris.

MR. R. W. REYNOLDS, has been appointed manager of the Springfield Street Railway, Springfield, Mass., succeeding the late MR. GEORGE F. REED, who died suddenly January 10. Mr. Reynolds has been secretary and general manager of the Hartford & Springfield Street Railway Company since August 1, 1912. Prior to that he was vice-president of the American Light & Water Company, Chicago, in charge of the construction of electric lighting plants and waterworks systems. He is a native of Mattoon, Ill., where he was born February 8, 1882, and graduated from Armour Institute, Chicago, in 1900. He spent two years in Purdue University, in the electrical engineering department, and then entered the traction business with the Indianapolis Northern Railway Company, now a part of the Terre Haute, Indianapolis & Eastern Traction Company. He became superintendent in 1905, and later became head of the operating department of the Chicago, South Bend & Northern Indiana Railway, being also in charge of the Southern Michigan Railway.

MR. W. CAMERON FORBES, former governor-general of the Philippine Islands, and a grandson of Ralph Waldo Emerson, has been elected a director of the New England Telephone & Telegraph Company. Mr. Forbes resides in Milton, Mass., where he was born in 1870. After graduating from Harvard he entered the importing firm of J. M. Forbes & Company, Boston. He was a member of the Philippine Commission and Secretary of Commerce and Police in the Islands, 1904-8. In 1908, he became Vice-Governor of the Philippines, later being appointed Governor by President Taft.

OBITUARY.

MR. WILLIAM HENDERSON WOOLVERTON, president of the Gamewell Fire Alarm Telegraph Company, New York, died on January 22, in Augusta, Ga. He was 73 years old.

DR. BENJAMIN OSGOOD PIERCE, since 1888 Hollis professor of mathematics and natural philosophy in Harvard University, died from disease of the heart at his home in Cambridge, on January 14.

MR. GEORGE H. BABBITT, a former member of the Vermont Public Service Commission, died at his home in Bellows Falls, Vt., on January 24, after a brief illness of acute indigestion. He was 59 years of age. Mr. Babbitt was appointed to the Commission about a year ago, but resigned in December owing to a disagreement with Governor Fletcher.

MR. CHARLES F. PRITCHARD, vice-president and general manager of the Lynn (Mass.) Gas & Electric Company, died at his home in that city January 21, at the age of 57 years, six months. Acute indigestion was the cause, resulting from an attack while attending sessions of the American Gas Lighting Association in New York last March. For a few months past, however, Mr. Pritchard had partially recovered, enough to be able to attend to his business until very recently. The deceased was born in Marblehead, Mass., and was graduated from the Massachusetts Institute of Technology in 1876. After a brief experience in the West he became superintendent of the Dedham Gas Works, in 1883, going to Lynn as superintendent of the gas company there. He became general manager in 1901, and in 1908 was elected to the position of manager of the Combined Lighting companies. Other lighting interests with which Mr. Pritchard was connected as director were the Fall River Gas Works Company, Gloucester Gas & Electric Company, Beverly Gas & Electric Company, Salem Gas Light Company and Boston Consolidated Gas Company. He was a member of the Lynn Chamber of Commerce, the Corinthian Yacht Club, and the Oxford Club of Lynn.

MR. WILLIAM COOPER, director of Buildings and Equipment of the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company, died from peritonitis at his home in Wilkinsburg, Pa., on Friday, January 23. Mr. Cooper was born near Watertown, N. Y., November 24, 1861. He was married on Christmas Day, 1895, to Ida J. Arnold, of Rockford, Ill., who survives him. He attended Cornell University and later went to Ottumwa, Iowa. Soon after he started a machine shop in Minneapolis for himself, undertaking at this time the development of a system of traction using compressed air. This work led to the investigation of the hydraulic speed-changing gear. Following this period, Mr. Cooper entered the employ of the Twin City Rapid Transit Company of Minneapolis as master mechanic and chief engineer. During the four years he spent in this position, he redesigned and practically rebuilt the entire electrical equipment. In 1894 he entered the employ of the General Electric Company in railway work. During three years at Schenectady he was a leading spirit in the work which resulted in the revolution of the design of railway motors. The principles of the design established at that time remained almost unchanged until the introduction of the commutating-pole motor. During his stay in Schenectady, he also supervised the manufacture of the locomotives for the Baltimore & Ohio Tunnel at Baltimore, being detailed to put them into service after their erection. After the completion of this work, Mr. Cooper became associated with the firm of Blood & Hale, consulting engineers, Boston, Mass. While with them he designed a line of railway motors for the Steel Motor Company of Johnstown, Pa., which were remarkable for their light weight. On September 1, 1897, Mr. Cooper entered the employ of the Bullock Electric & Manufacturing Company, Cincinnati, O., as general superintendent, in charge of engineering and manufacturing. In 1904 he entered the employ of the Westinghouse Electric & Manufacturing Company in the railway engineering department. His unit switch control led to the development of the type of control now being used by the Westinghouse Company. His work in the railway field consisted of an active participation in the design and manufacture of the equipment furnished the New York, New Haven & Hartford Railroad, the St. Clair Tunnel, the Pennsylvania Railroad, and other roads which have been electrified by the Westinghouse Company. Following the completion of the development in control system, Mr.

William Cooper.

Cooper was appointed engineering inspector. Two years ago, when the works department was organized, Mr. Cooper was made director of buildings and equipment. In this capacity he did some excellent work in remodelling the power plant at East Pittsburgh, leaving it in excellent condition. Mr. Cooper was a man of rather rough exterior and apt to be misunderstood by people who did not know him thoroughly. His warm heart, however, and the generous disposition made him universally loved and respected by those fortunate enough to know him intimately.

DATES AHEAD.

Iowa Electrical Contractors' Association. Organziation meeting, Waterloo, Iowa, February 2.

Wisconsin State Telephone Association, Madison, Wis., February 11-12. Secretary, P. J. Weirich, Monroe, Wis.

American Institute of Mining Engineers. Annual convention, New York, N. Y., February 17-20. Secretary, Bradley Stoughton, 29 West Thirty-ninth Street, New York, N. Y.

Electrical Supply Jobbers' Association. New Willard Hotel, Washington, D. C., February 17-19. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

American Institute of Electrical Engineers. Annual mid-winter convention, Engineering Societies Building, New York, N. Y., February 25-27. Secretary, F. L. Hutchinson, 29 West Thirty-ninth Street, New York, N. Y.

State Independent Telephone Association. Des Moines, Iowa, March 10-12. Secretary, Charles C. Deering, 309 Life Building, Des Moines, Iowa.

Telegraphers' Mutual Benefit Association. New York, N. Y., March 11. Secretary, M. J. O'Leary, 195 Broadway, New York, N. Y.

Buffalo Electric Show. Elmwood Music Hall, Buffalo, N. Y., March 9-14. Secretary, Harry S. Hilliker, Electric Building, Buffalo, N. Y.

Peoria Electric Show. Peoria, Ill., March 9-15. Director, T. D. Buckwell, Central Illinois Light Company, Peoria, Ill.

American Railway Engineering Association. Annual convention, Chicago, Ill., March 17-20. Secretary, E. B. Burritt, 29 West Thirty-ninth Street, New York, N. Y.

American Electrochemical Society. Twenty-fifth general meeting, New York, N. Y., April 16-18. Secretary, Joseph W. Richards, Lehigh University, South Bethlehem, Pa.

National Electric Light Association. Annual convention. Bellevue-Stratford Hotel, Philadelphia, Pa., June 1-5. General Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York, N. Y.

With the Electrical Manufacturers

The Dyer Flaming Arc Company, Incorporated, Philadelphia, Pa., announces its removal from 225 North Tenth Street to 1714 Sansom Street.

The Beck Electrical Construction Company, 204 Andrus Building, Minneapolis, Minn., has been appointed representative for the American-Ball engine and the Rice & Sargent Corliss engine for the Minnesota territory adjacent to Minneapolis.

Benjamin Electric Manufacturing Company, Chicago, Ill., maker of electric lighting specialties, was awarded a gold medal for its electric lamp grip and its punch-press safety device by the jury of award of the first International Exposition of Safety and Sanitation held in New York recently under the auspices of the American Museum of Safety.

Rome Wire Company, Rome, N. Y., has issued its annual "Copper History." This gives in tabular form the monthly and average yearly cost of copper from January, 1884, to January, 1914. This shows strikingly the ups and downs of the copper industry for the past 30 years. A copy of the pamphlet will be sent to anyone interested on request to the company.

Ward Leonard Electric Company, Bronxville, N. Y., has issued a circular calling attention to the merits of its electrically operated Nodaz device, which, as its name indicates, is a means of reducing the glare or dazzle of powerful automobile headlights so as to make them safe for city streets. By merely pushing a button the full power of the light can be instantly obtained for country driving.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., announces that H. B. Squires Company, of San Francisco and Portland, its Pacific Coast agent, has taken over the additional territory of Southern California, establishing a branch office in the San Fernando Building, Los Angeles. C. W. Yerger, who has been connected with the engineering department of the Cutler-Hammer Manufacturing Company at Milwaukee for several years, will be in charge of the Los Angeles office.

The Kerr Turbine Company, Wellsville, N. Y., announces that on January 1 its Southern interests were placed in the hands of the International Steam Engineering Company, with main office in the Grant Building, Atlanta, Ga., and branches in Realty Trust Building, Charlotte, N. C., and Brown-Marx Building, Birmingham, Ala. James E. Weinbold will give personal attention to new business in territory including North and South Carolina and eastern Tennessee; Robert Stevens to Mississippi and Alabama and W. R. Jennison to all other Southern territory.

Orr & Lockett Hardware Company, Chicago, has just issued a bulletin describing its new Drilhammer. This device can be used for drilling in concrete, stone, brick marble, etc., in walls, floors, ceilings or corners. It is especially adapted for use where electric or pneumatic power is not available, or where the amount of work to be done is small. It can be carried in any ordinary tool kit. This device will undoubtedly be found indispensable by contractors, electricians and others. The new bulletin mentioned above will be mailed on request.

The National Reinforced Concrete Pole, Pile & Pipe Company, Denver, Colo., has issued a large and attractively prepared prospectus describing the manufacture of reinforced-concrete poles, piles, etc., according to the process invented by R. M. Jones. The prospectus contains an article showing the economy and reliability of reinforced-concrete poles for use in building overhead electric lines. A description of the Jones process is given in considerable detail and with the aid of numerous illustrations. The process is equally serviceable for making solid or hollow poles and piles.

The Lombard Governor Company, Ashland, Mass., has adopted as its trade mark a replica of the original iron crown of Lombardy. This was a symbol of the early Lombard supremacy. The company states that it has adopted the trade mark inasmuch as the Lombard governor has the virtues of rugged strength and refinement, and combines these for supremacy in the field of governing water wheels as successfully as did the Lombard race in government of the political and military sort. The company is distributing a series of interesting cards showing famous plants which are Lombard-governed.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., reports the recent shipment to a large railway company in the Middle West of a 26-panel switchboard in record-breaking time. On November 28 the contract for the board was signed, calling for delivery in 26 days, with a bonus and penalty clause. On December 10, or 12 days later, the entire switchboard was shipped complete from the works, and it was done without employing any overtime. The board is designed to control one 800-kilowatt 250-volt direct-current generator; two 275-kilowatt 250-volt direct-current generators; two exciters; two 850-kilowatt 480-volt three-phase generators; the remainder of the panels are devoted to alternating-current and direct-current feeders.

The Terry Steam Turbine Company, Hartford, Conn., in a recent publication (Bulletin 17) calls attention to its return-flow turbine. This type of turbine, which is being generally adopted abroad for condensing tur-

bines where maximum economy is sought, is a combination of a multi-velocity stage element for the high-pressure end with a series of multi-pressure stage elements in the low-pressure end. Ferry steam turbines were the first to make use of this design in this country. The company feels gratified at the indorsement of its choice of design, since so many other turbine builders are now adopting it. The bulletin sets forth the advantages of this construction, which is described in considerable detail with the aid of illustrations.

The Dubilier Electric Company, Incorporated, 63 Fifth Avenue, New York, has published a catalog devoted to the Dubilier electric specialties. This refers particularly to resistance units, heating material, high-frequency apparatus and devices for medical and therapeutic and dental purposes. The Dubilier resistance elements are of a definite type and are designed especially to provide a simple, inexpensive resistance of an indestructible, compact, non-inductive character. Special information is available respecting the company's cord resistance. This is particularly suitable for certain heating appliances, as it possesses advantages of being unbreakable, jointless, unaffected by continual heating and cooling, compact and easily, quickly and inexpensively mounted.

Record of Electrical Patents.

Issued by the United States Patent Office, January 20, 1914.

1,084,595. Booster Regulation. C. Ambruster and H. M. Beck, Chicago, Ill. Has means for continually applying electromotive forces of alternating polarity to the field coil of the regulating armature.

1,084,603. Lighting Attachment for Alarm Clocks. A. T. Britt, Kansas City, Mo. Includes a battery, electric lamp and means for lighting the lamp when the alarm rings.

1,084,610. Railway Signaling System. W. J. Cook and S. Deutsch, assignors to Cook Railway Signal Co., Denver, Colo. A relay-controlled electric motor raises the semaphore arm to "safe" position.

1,084,611. Accounting Device. W. J. Crumpton, assignor to W. R. Heath, Buffalo, N. Y. Consists of a number of individual registers each with a separate electromagnetic actuating mechanism, and means for totalizing the actuation of all the registers.

1,084,613 to 1,084,615. Accounting System. W. J. Crumpton, assignor to W. R. Heath. These three patents cover various features of an electromagnet register-actuating device.

1,084,629. Zirconium Lamp-Filament. C. A. Hansen, assignor to General Electric Co. Produced by mixing gelatinous zirconium oxalate with finely powdered carbon, shaping the mixture into threads and heating to produce pure zirconium.

1,084,633. Actuating Mechanism for Accounting Registers. F. O. Heuser, assignor to W. R. Heath, Buffalo, N. Y. Electromagnetically operated and time-governed.

1,084,634. Two-Way Register-Actuating Mechanism. F. O. Heuser, assignor to W. H. Heath. A modification of the foregoing.

1,084,641. Advertising Device. H. J. Keating, Chicago, Ill. Includes a solenoid-operated cam for moving the arm of the figure.

1,084,645. Electrical Appliance. J. H. Lehman, New York, N. Y. Relates to details of a circuit-breaker.

1,084,651. Automatic Control and Safety Device for Moving-Picture Machines. J. McFeely, assignor of three-fourths to M. E. Petty and H. E. Petty, Chicago, Ill. The motor-driven film machine and arc lamp are provided with speed-governed circuit-breaker to extinguish the lamp and stop the motor when the film speed becomes abnormal.

1,084,657. Cover for Telephonic Apparatus. G. H. Nash, assignor to Western Electric Co. Consists of two cylindrical parts fastened by a helical groove and a projection.

1,084,660. Accounting System. A. F. Poole, assignor to W. R. Heath. Includes a number of individual registers, each adapted to be actuated by electric current impulses, and a totalizing register actuated at a rate proportionate to the sum of the rates of all the individual registers.

1,084,661. Accounting System. A. F. Poole, assignor to L. A. Williams, Evanston, Ill. A modification in which each individual register is electromagnetically actuated by a current of different frequency.

1,084,669. Accounting System. C. H. Tallmadge, assignor to W. R. Heath. Includes a number of electrically operated burden registers.

1,084,670. Piecework - Accounting System. C. H. Tallmadge, assignor to W. R. Heath. Includes an electrically operated wage register and a piece-rate register.

1,084,672. Automatic Time-Accounting Device. A. A. Thomas, assignor to W. H. Heath. An electrically operated mechanism for periodically actuating a ratchet wheel.

1,084,673. Stop-Welding Machine. E. Thomson, assignor to Thomson Electric Welding Co., Lynn, Mass. One transformer secondary terminal is fixed and the other connects with a laminated conductor looped around the work to the welding gap.

1,084,674. Maintaining a Constant Power Factor in a System of Distribution. A. A. Tirrill, assignor to General Electric Co. An automatic regulator for the field circuit of a polyphase synchronous condenser.

1,084,678. Picture-Projecting Machine. A. F. Victor, Davenport, Iowa. Has specially adjustable carbons to arc at a fixed point between the lens and slides.

1,084,684 and **1,084,685. Accounting System.** L. A. Williams, assignor to W. R. Heath. The first patent provides a number of electromagnetically operated registers, each having a wage and a time indicator. The second patent provides a number of electrically operated waste-wage registers and job registers.

1,084,698. Controlled for Electric Motors. J. H. Hall, assignor to Electric Controlled & Mfg. Co., Cleveland, O. Electromagnetic starting switch for connecting an induction motor to an autotransformer and a similar running switch to connect the motor direct to line.

1,084,703. Electric Cutout. A. V. A. McHarg, assignor to T. E. Murray, New York, N. Y. On a base block through which busbars pass are contacts for a multipolar switch lever with fuse plugs.

1,084,706. Fuse Plug. T. E. Murray, New York, N. Y. A fuse strip is doubled over one end of an elongated plug and metallic contact plates are screwed on opposite sides of the plug and cover the end edges of the fuse strip.

1,084,713. Lamp Reflector. J. C. Stearns, Worcester, Mass. An automobile lamp, the central portion of whose reflector is removably secured to the outer portion to permit insertion of an electric lamp from the rear.

1,084,714. Electrical Connection. J. C. Stearns. For connecting a cable to an automobile lamp.

1,084,720. Electric Meter. G. M. Willis, assignor to Chicago Electric Co., Chicago, Ill. Has a cover adapted to retain the field coil in position and to protect the armature.

1,084,721. Shunt for Measuring Instruments. G. M. Willis, assignor to Chicago Electric Meter Co. Comprises a thin flat element of resistance metal formed into a split ring having a predetermined resistance and coefficient of self-induction.

1,084,722. System of Electrical Distribution. J. L. Woodbridge, Philadelphia, Pa. The division of load between a generator and a storage battery is controlled by a regulator for the booster field.

1,084,723. Dynamo-Electric Machine. J. L. Woodbridge. A separately excited commutator machine with a conducting squirrel-cagke structure surrounding the armature close to its periphery.

1,084,726. Safety Appliance for Elevators. J. A. Butkus, Baltimore, Md. An electric signal associated with the controller rope.

1,084,741. Electrical System of Distribution. R. C. Hull, assignor to Electric Storage Battery Co., Philadelphia, Pa. Two resistances of different temperature coefficients are connected to the extreme terminals of a dynamo, which has two short-circuited brushes to which one side of the field is connected, the other being connected between the two resistances.

1,084,745. Electric Primer. C. F. Lindsay, assignor to Union Metallic Cartridge Co., Bridgeport, Conn. A plug containing an explosive has electric ignition contacts.

1,084,759. Carrier-Dispatch System. F. L. Soule, assignor to Lamson Co., Boston, Mass. A timing mechanism

lights an electric lamp when a carrier remains in a repository beyond a certain time limit.

1,084,765. Signaling System for Railways. J. D. Taylor, assignor to Union Switch & Signal Co., Swissvale, Pa. A polarized signal-controlling relay is connected to the track rails.

1,084,780. Signaling System. C. E. Beach and H. W. Doughty, assignors to G. O. Knapp, New York, N. Y. An electromagnet governs the starting and stopping of the signal.

1,084,800. Electric Alarm. A. Hoge, New York, N. Y. Attached to an ordinary alarm clock.

1,084,809. Light-Reflecting Device. E. C. McKinnie, assignor to National X-Ray Reflector Co., Chicago, Ill. An illuminated-bowl indirect unit, with a diffusing portion in the bottom of an opaque deflector that fits within a glass bowl. (See cut.)

1,084,813. Chain Support. W. H. Murray, Harrison, N. Y. A wire with a loop about the pull socket extends out and has a hook to engage the chain; a pull cord hangs from the hook. (See cut.)

1,084,822. Loud-Speaking Attachment for Telephones. H. W. Prance, London, England. A trumpet is placed near the telephone receiver.

1,084,838. Spark Plug. C. W. Beck, assignor to Michigan Motor Specialties Co., Detroit, Mich. Is provided at its inner end with a movable expansion device and means for indicating the movements of the device.

1,084,863. Trolley. C. D. Larrabee, Syracuse, N. Y., assignor of one-half to S. Hubbell. Has a special spring to restrict swiveling of the harp.

1,084,877. Electric Heating Table or Counter. E. C. Cary, Baltimore, Md. Countersunk recess for flat-bottom vessels are provided with heating ele- Countersunk recesses in the table for flat-bottom vessels are provided with heating elements.

1,084,903. Insulated Rail-Joint. E. F. Schermerhorn, assignor to Rail Joint Co., New York, N. Y. The rail ends are insulated from each other; one rail head and all the flanges are insulated from the joint bars.

1,084,905. Sight Illuminator. E. Schwarz, Lincoln, Min. An electric light for a firearm.

1,084,907. Tactical Naval Tracer. F. Spalazzi, Rome, Italy. Electrically operated automatic tracing device.

1,084,910. Method for Localizing Faults in Cables and Circuits. J. H. J. A. Stephenson, Hamburg, Germany. A voltmeter is used similarly to an ohmmeter.

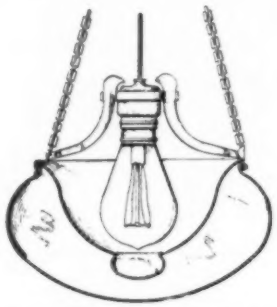
1,084,924. Magneto-Electric Generator. M. C. Brenot, assignor to firm Robert Bosch, Stuttgart, Germany. Includes an interrupter with a number of cams to move the interrupter contacts at the irregular intervals of ignition required by the engine.

1,084,926. Hand Lamp. C. F. Burgess, Madison, Wis. A tubular battery lamp with telescopically adjustable lens.

1,084,931. Starter and Ignition Control. J. B. Entz, assignor to White Co., Cleveland, O. A switch for changing the starting motor into a battery-charging generator and also controlling ignition circuit.

1,084,932. Testing Device for Jump-Spark Ignition Systems. T. H. Estes, Texarkana, Tex. An insulated handle with a concentric contact and an integral offset bridging contact.

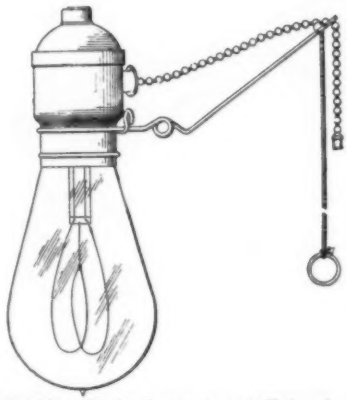
1,084,936. Electric Ground-Clamp. R. R. Forbes, Mount Holly, N. J. Consists of a two-part strap far passing



1,084,809.—Illuminated-Bowl Indirect Unit.

around a ground pipe, a clamp and a terminal for the ground wire.

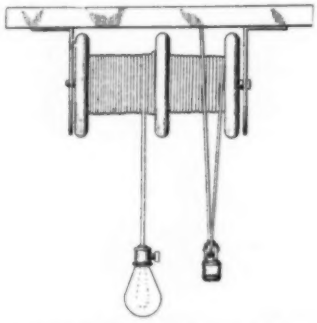
1,084,960. Lamp-Cord Reel. M. I. Randall, Bellingham, Wash. A spring drum in two sections has the cord



1,084,813.—Chain Support and Extension.

wound around one part in one direction and on the other part in the opposite direction. (See cut.)

1,084,966. Telephone Stand. J. W. Rodes, University, Va. The two parts of the stand are vertically adjustable and the upper part has a U-shaped



1,084-960.—Lamp-Cord Reel.

yoke for the purpose of holding the receiver to the ear.

1,084,988. Trolley Wheel. C. C. Williams and W. E. Fry, Anderson, Ind. Has a spiral replacer wheel on each side of the trolley wheel.

1,085,011. Equipment for Locomotives. C. L. Bopp, Waterloo, Iowa. A bracket and brush contact for an inverted third rail or similar conductor.

1,085,012. Electric Time-Release Air-Valve. C. L. Bopp. Includes an electromagnetically controlled ratchet wheel.

1,085,023. Electric Insett-Trap. S. A. Craig, El Paso, Tex. Adjacent wires of opposite polarity are spirally wound around the periphery of the revolving drum.

1,085,024. Spark Plug. A. de Clairmont, assignor to Toledo Automobile Devices Co., Toledo, O. A ball on an adjustable rod constitutes the central electrode.

1,085,036. Selective Apparatus. G. H. Groce, assignor to General Railway Signal Co., Gates, N. Y. A selective electric signaling system.

1,085,069. Telautographic Apparatus. G. S. Tiffany, assignor to Gray National Telautograph Co., New York, N. Y. Covers details of a telautographic register.

1,085,089. Process of Electric Welding. L. S. Lachman, assignor to Universal Electric Welding Co., New York, N. Y. For producing an open frame; consists in preparing primary and secondary members; placing them together with an edge of one in contact with the surface of the other, and passing a welding current through the junction.

Patents Expired.

The following United States electrical patents expired January 26, 1914.

575,699. Electromechanical Movement. E. D. Chaplin, Cambridge, and H. G. Halloran, Boston, Mass.

575,724. Gearing for Electric-Car Motors. A. C. Mather, Chicago, Ill.

575,733. System for Electric Signaling. W. M. Ramsey, Allegheny, Pa.

575,767. Apparatus for Determining Electrical Resistances Containing Electormotive Forces. O. Frolich, Charlottenburg, Germany.

575,772. Roentgen-Ray Tube. E. Thomson, Swampscott, Mass.

575,777. Electric Meter. W. C. Fish, Lynn, Mass.

575,782. Rail Support. W. B. Potter, Schenectady, N. Y.

575,785. Closed-Conduit Electric Railway. E. W. Rick, Jr., Schenectady, N. Y.

575,805. Electrical Signal System. P. Freeman, New York, and R. E. Slater, Montrose, N. Y.

575,826. Electric Furnace. J. A. Deuther, Boston, Mass.

575,829. Electric Furnace. J. Joyce, Andover, and J. A. Deuther, Boston, Mass.

575,830. Printing Telegraph. O. L. Kleber, Pittsburgh, Pa.

575,869. Telephone Transmitter. R. S. Barnum, Chicago, Ill.

575,887. Microphone. P. Hardegen, Berlin, Germany.

575,896. Telephonic Transmitter. M. Katvra, London, England.

575,908. Switch and Signal Apparatus. J. G. Schreuder, Edgewood Park, Pa.

575,918. Brush-Carrier for Dynamo-Electric Machines. S. S. Wheeler, New York, N. Y.

575,952. Insulator. F. Hoover, Paducah, Ky.

576,053. Electric Appliance for Horses. L. A. Gray, Arlington, Md.

575,788. Electric Smelting. T. L. Willson, New York, N. Y.